OCTOBER, 1943

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TOOL & DIE JOURNAL

TOOLING AND PRODUCTION

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PUTNAM TOOL COMPANY

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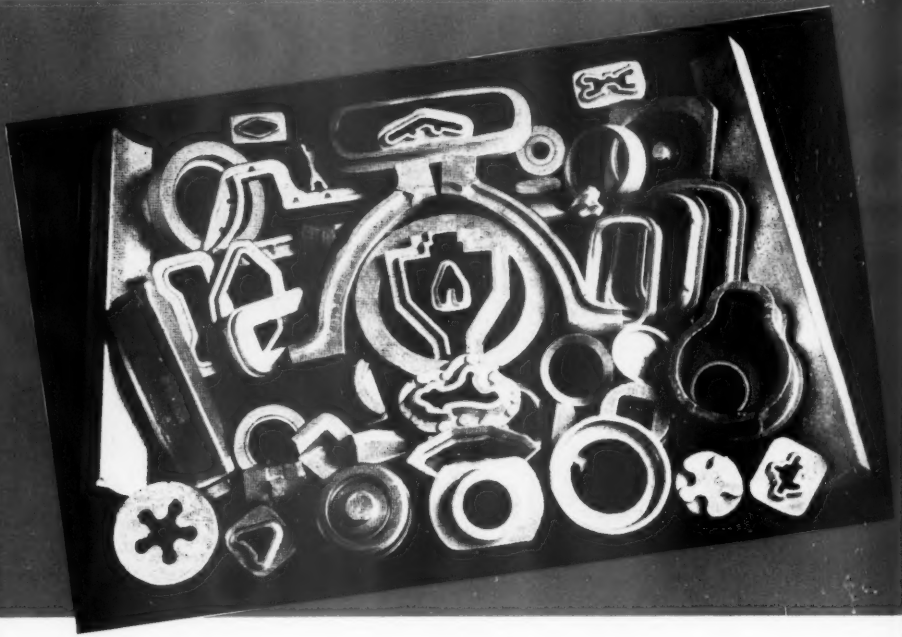

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Use FCC Air Hardening Tool Steel Cast-to-Shape for blanking, forming, drawing, swaging and embossing dies; also for bushings, cams, shears, rolls and similar tooling.

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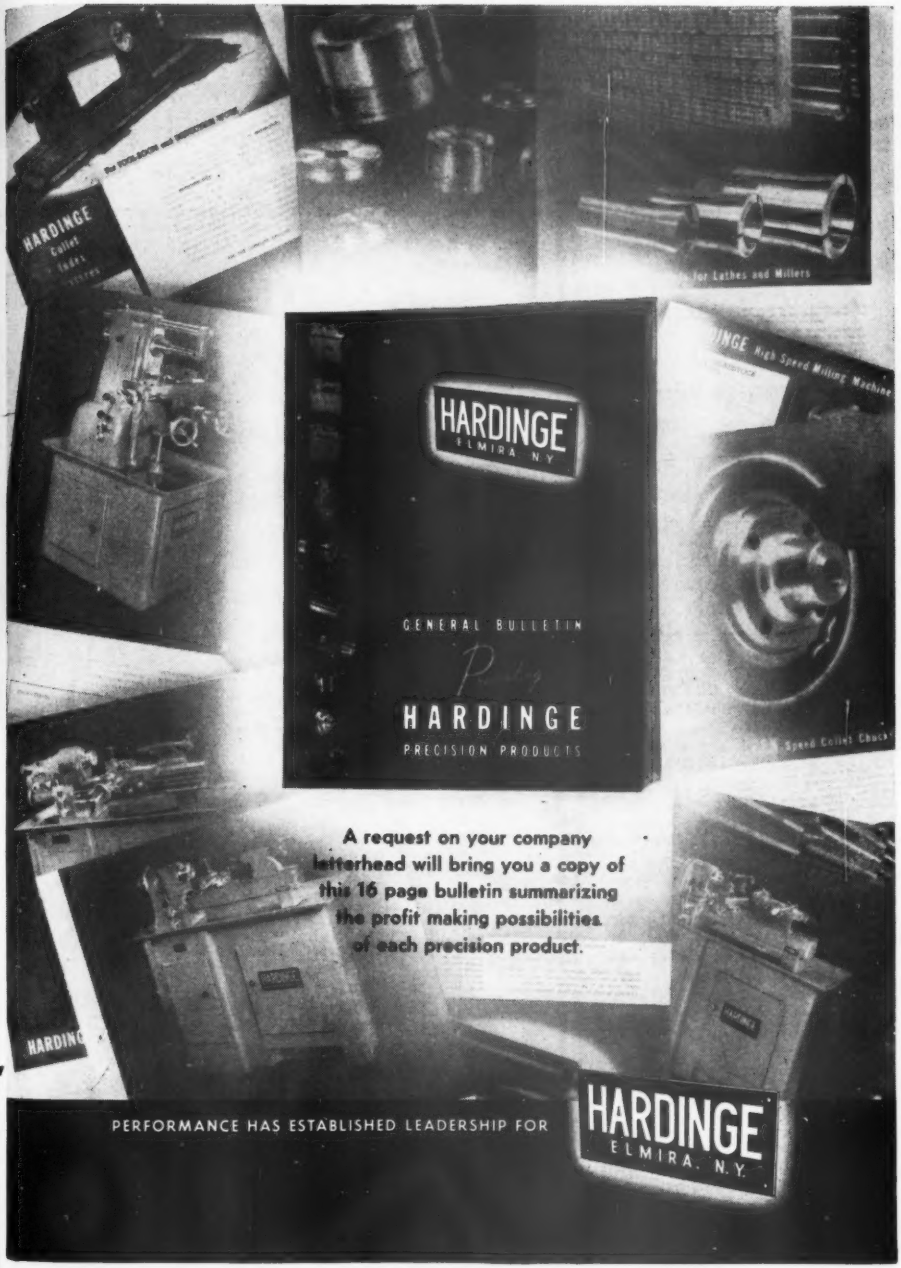
HARDINGE
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HARDINGE
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A request on your company
letterhead will bring you a copy of
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THE TOOL & DIE JOURNAL

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(For fuller descriptions of these grades, see pages 10 and 11 of Firthite Users' Handbook—or consult a Firthite Engineer.)

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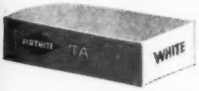

TA — **The general-purpose carbide** for cutting all types of steel in high-speed production. TA machines both ferrous and non-ferrous materials, such as aluminum.

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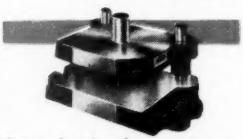

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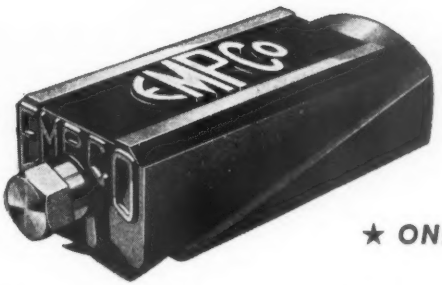

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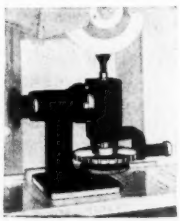

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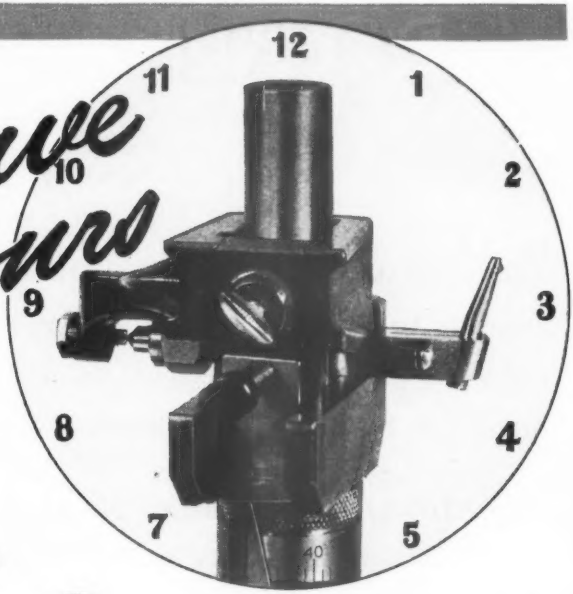

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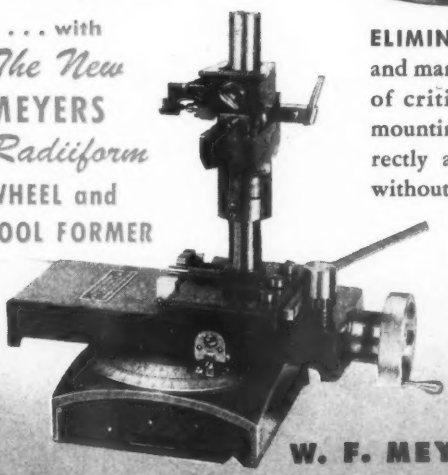

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THE TOOL & DIE JOURNAL OCTOBER, 1943

14

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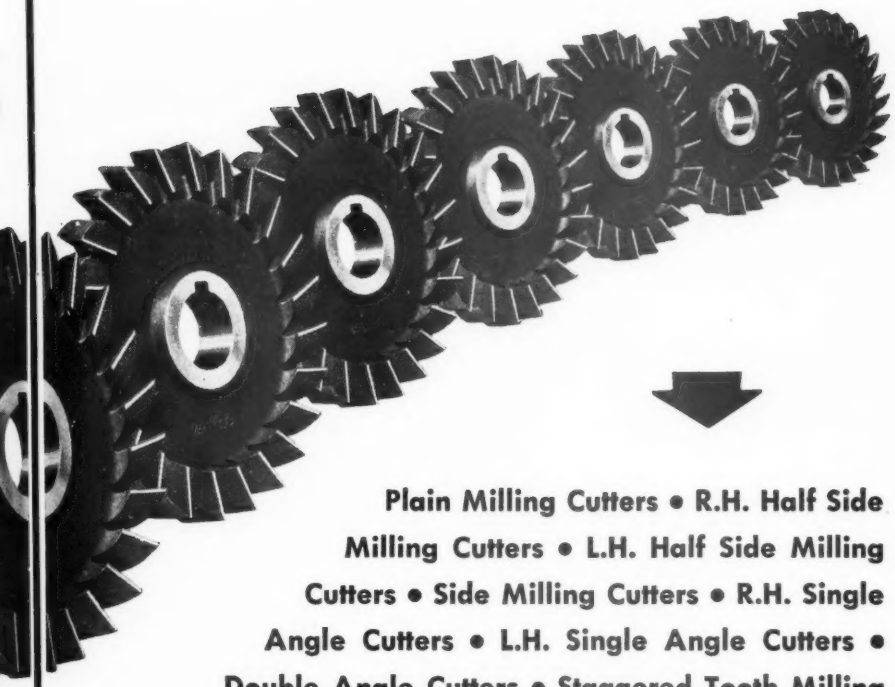

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M-468

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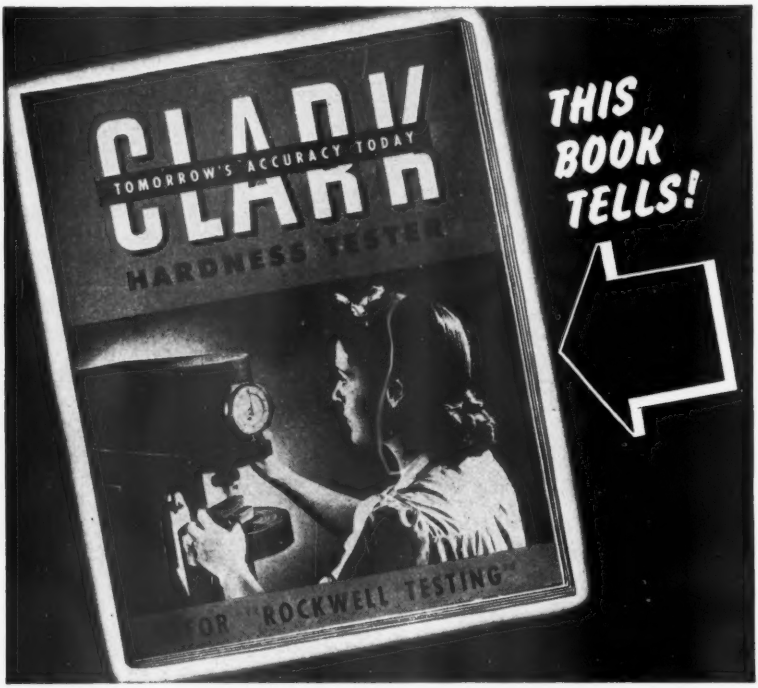

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TOMORROW'S ACCURACY TODAY
HARDNESS TESTER

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It is a 20-page reference manual on the history, theory, practice, and equipment for modern, scientific hardness testing. Printed in two colors, 8½" x 11", it is available without charge to manufacturing executives. Just drop a line on your letterhead to Department TD, CLARK INSTRUMENT INC., 10200 Ford Road, Dearborn, Mich.

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GIVES TOOLS 300% LONGER LIFE

RACINE Tri-Chrome
RECLAIMS VITAL PARTS AND TOOLS

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Ask for a Gray-Mills demonstration. Call your distributor, or write direct. Send for Catalog.

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Large capacity tanks—forced settling baffles and screens—Capacities: centrifugal type up to 3,000 g.p.h.—gear type up to 165 g.p.h., pressures, 50 lbs. p.s.i.

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Capacities up to 130 g.p.h.—pressure, 30 lbs. p.s.i.

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Complete Portable Coolant Systems

Use GRAY-MILLS COOLANTS . . . 5 types for most requirements—10 and 55 gal. containers—immediate delivery from your distributor or our plant.

Here's how Advance hard chrome plating salvaged badly worn screw machine shafts . . . and saved days of vital production time in the bargain!

These shafts, measuring 30" in length and approximately 2½" at their largest diameter, were so badly worn they would no longer function. Each was worn to a different degree, some .015" to .020" and one as much as .035".

Because the three separate sections of the shaft required plating to slightly different diameters, it was necessary for Advance engineers to design special fixtures for the job. Once plated, however, the parts were ground to specifications and the shafts quickly placed back in production. In this case, hard chrome plating not only held loss of production time to a minimum but meant a considerable saving in strategic metals as well.

SPECIFY *Advance* HARD CHROME PLATING

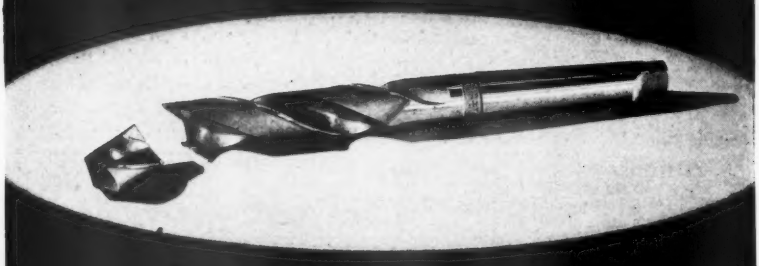
Our engineers will be glad to study your shop problems and suggest plating operations that will cut tool costs, increase production, keep rejects at a minimum and conserve equipment.

Write, Wire or 'Phone

HARD CHROME DIVISION
THE ADVANCE PLATING COMPANY
395 E. 131st Street • CLEVELAND 8, OHIO • Tel. GLenville 6742

APCO

A BREAK FOR THE AXIS



Much tool breakage is caused by over-dulling. Cutting tools should be examined periodically while in action; they should be sharpened at regular time or production intervals, regardless of their apparent condition.

Besides being less liable to breakage, sharp tools will:

1. Last longer, because less material is removed when re-sharpening
2. Produce more, and with better finish.
3. Insure utmost accuracy, with fewer rejects.
4. Reduce tool and labor costs per unit.

Sharp tools are economical tools. Keep them working for Victory!

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It's New... Logan
QUICK CHANGE GEAR LATHE

with
FRICTION FEED
AUTOMATIC APRON

Precision Built FOR SUSTAINED ACCURACY

The variety of work it handles... the speed, accuracy, and safety of its operation place this new lathe in a class by itself. It combines compactness, economy and versatility. With its friction feed automatic apron and precise construction throughout, this new Logan Quick Change Gear Lathe is by every standard a rugged, highly adaptable machine of sustained accuracy. Bed ways, for example, are precision ground to within .001", of absolute accuracy. Total run out of the headstock spindle 12 inches from the bearing is less than .001". The lead screw is held to within .002" in 12 inches. All moving parts are protected by ball bearings or by self-lubricating bronze bearings. As for economy, the new Logan No. 820 quickly pays for itself through lowered unit costs.

LOGAN ENGINEERING COMPANY · Chicago, Illinois

Brief Facts

- Swing over bed 10½"
- Bed length 43½"
- Spindle hole 25"/32"
- Precision ground ways: 2 prismatic "V" ways; 2 flat ways
- 12 spindle speeds—30 to 1450 per minute
- Worm drive from lead screw spindle for power feeds
- Friction clutch on power feeds
- Longitudinal feed .0015 to .1000" per spindle revolution
- Cross feed .25 times longitudinal feed
- Half nut drive from lead screw thread for thread cutting

Threads—48 selections RH or LH—4 to 224 per inch

Logan

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When it comes to jewel-like high precision parts production you need "all three". For this dynamic combination of skilled men—the right machine—continous supervision —means *uniform* precision on every piece of work—on every type of job. Smillie, as subcontractor, is applying this "all three" precision performance toward meeting critical assignments for aircraft—and other major war industries. If we can help—wire, write, or phone.

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Serving Industry and the Nation for 54 years

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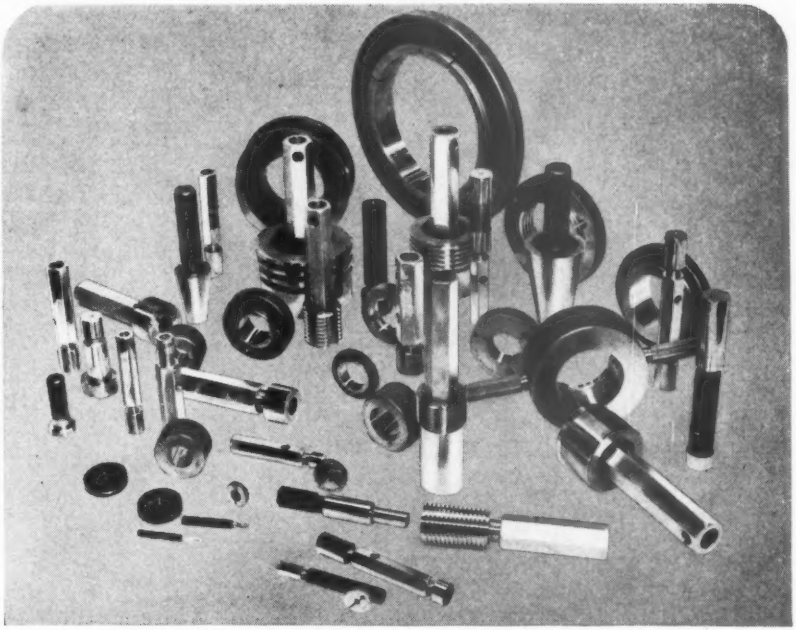

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Right now, our industries are working to produce better machines for war—and more of them.

In this effort gages have an important part. They control the accurate dimensions which make modern mass production, with its interchangeability of parts, a practical manufacturing method.

One day—perhaps soon—much of this war production will again return to the making of the products of peace. Again, gages will have an important share in making those products better and more plentiful.

Gages bearing the PM Diamond emblem are ACCURATE. That one word tells the whole story, for accuracy is the only reason for using a gage.

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DIE DESIGNING AND ESTIMATING

CONTENTS

New Chapters include: Progressive Dies; Compound Dies; Drawing Dies *(Deep drawing section on cartridge case design, mathematical and graphical methods of determining diameters, shell wall thicknesses, punch and die sizes)*
Outline of Equipment and Operations for Manufacture of Small Arms Cartridge Cases.
15 New Estimating Tables.
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★ **"Will be extremely helpful to us . .", "very practical", "even better than I had hoped it would be" — these are comments by men in the precision tooling industry who have examined the new second edition of "Die Designing and Estimating". Orders for 50 copies (most on a second order after the book was reviewed) from a public library, 28 copies from an airplane manufacturer, 24 from an apprentice training instructor testify to the usefulness of this book. Largely written on request by specialists, the book covers its subject concisely, systematically and with authority.**

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4 HANDLES—
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This new improved Model KP 830 is now about the strongest clamp for its size on the market.

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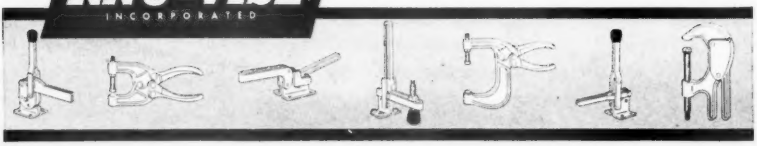

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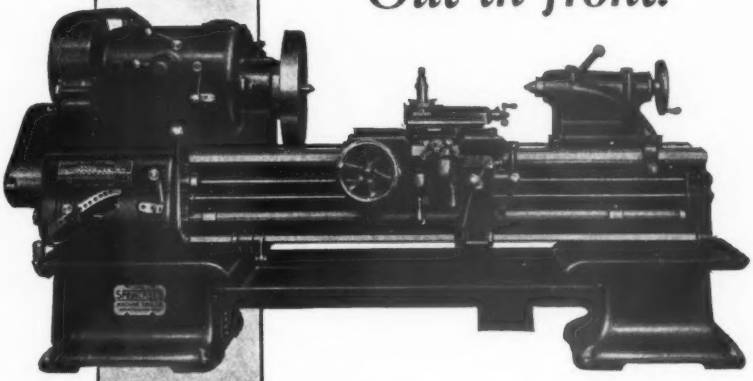
Out in front!



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Tells the why and how of Springfield's accurate production.

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The machine here illustrated, for instance, by interchanging two tapping heads will handle from a No. 2 tap up to a 5/16" tap in steel, 3/8" in cast iron and 1/2" in brass and aluminum. That means that in your shops *one* Procunier can do the work of two or more machines.

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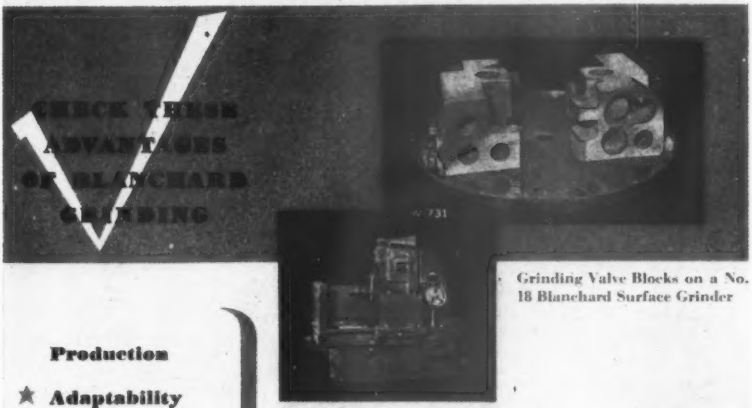

Grinding Valve Blocks on a No. 18 Blanchard Surface Grinder

Production
★ **Adaptability**
Fixture Saving
★ **Operation Saving**
Material Saving
Fine Finish
★ **Flatness**
Close Limits

. . . . . *Especially valuable on jobs like the one illustrated.*

These cast iron valve blocks are finish ground from rough castings on the Blanchard surface grinder.

3/16″ of stock is removed from two sides of these valve blocks to limits of ±.005″. 4 pieces (8 surfaces) are produced per hour.

The close tolerances required between centers of bored holes and sides of block are easier to maintain because of the flat and parallel surfaces produced by Blanchard Grinding. Subsequent operations are always more accurate and made easier when the first operation is performed on a Blanchard.

BLANCHARD

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

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This small compact electric furnace is inexpensive, handy and easy to operate—ideal for small tool and die shops—saves time these five different ways:

1. Eliminates delays in sending small machine parts out to overcrowded commercial heat treaters.
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3. Cuts handling time when normalizing or annealing small parts. No waiting.
4. Conveniently available for pre-heating for subsequent high-speed hardening.
5. Eliminates shut downs and delays in servicing emergency repair orders.

AVAILABLE IN TWO SIZES

Type	*Chamber Capacity*	*Amps 115 V*	*Watts*	*Amps 230 V*	*Price*
MH-3	8″W 6″H 14″L	29.6	3400	14.8	$124.00*
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**Includes Hearth Plate*

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.

AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire complete—$152.40.

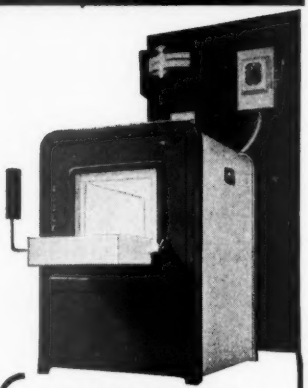

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Table	4½" x 18"
Table Travel Longitudinal	10"
Table Travel Vertical	6"
Number of Spindle Speeds	12
Speed Range	61 to 2860 RPM
Overall	25½" x 32½" x 22"
Motor	1/3 HP 1740 RPM

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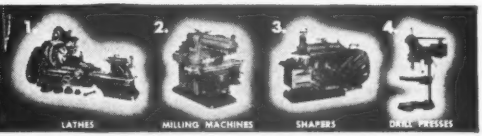

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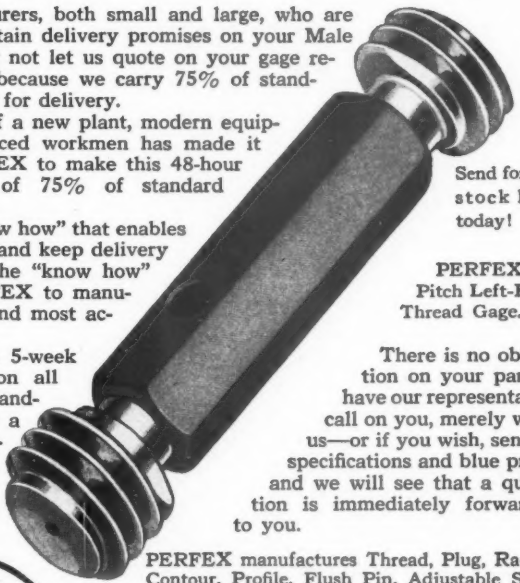

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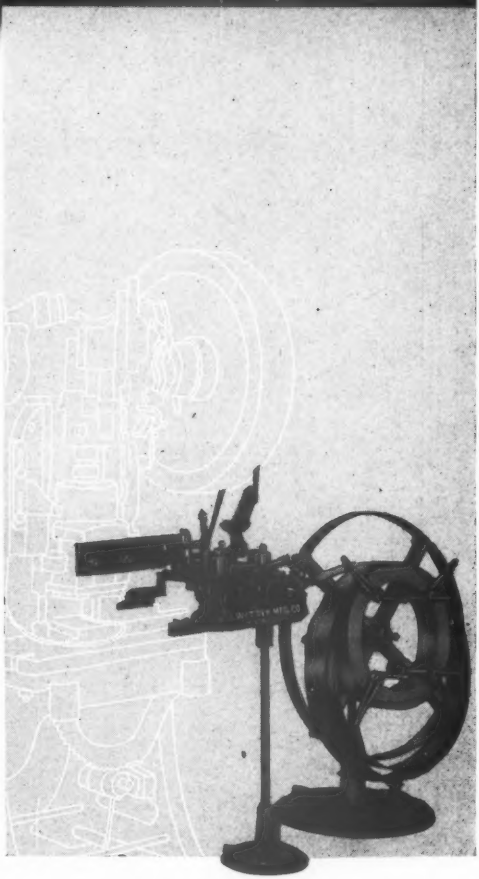

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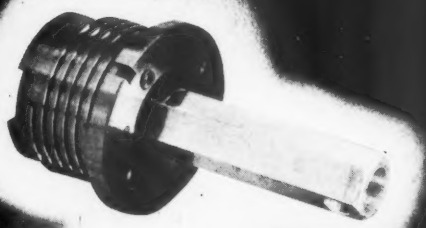

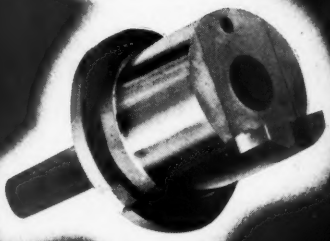

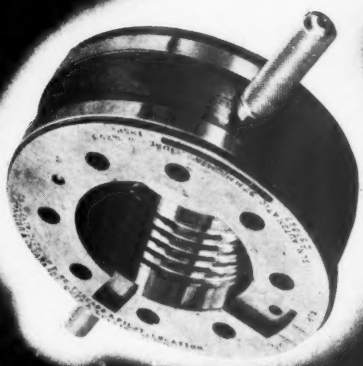

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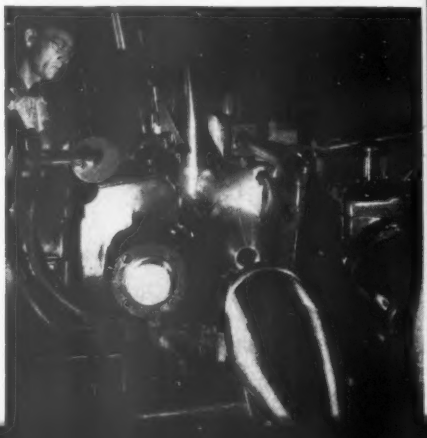

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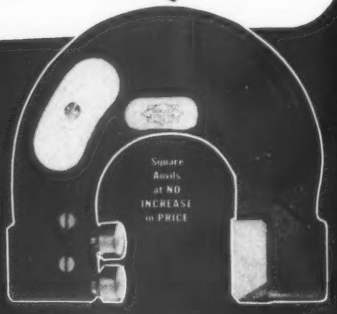
Popular Sizes are now Available for

Immediate Delivery



A. G. D.
STANDARD
ADJUSTABLE
LIMIT

SNAP GAGES

Complete Range of Models and Sizes Attractively Priced

Satisfaction Guaranteed

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PRICE LIST

Quality
TOOL & DIE CO.
N. Noble and E. Vermont
INDIANAPOLIS 2, INDIANA

Manufacturers of
"QUALITY
PRODUCTS"
★
Speed Victory—
Buy more War Bonds

FORD

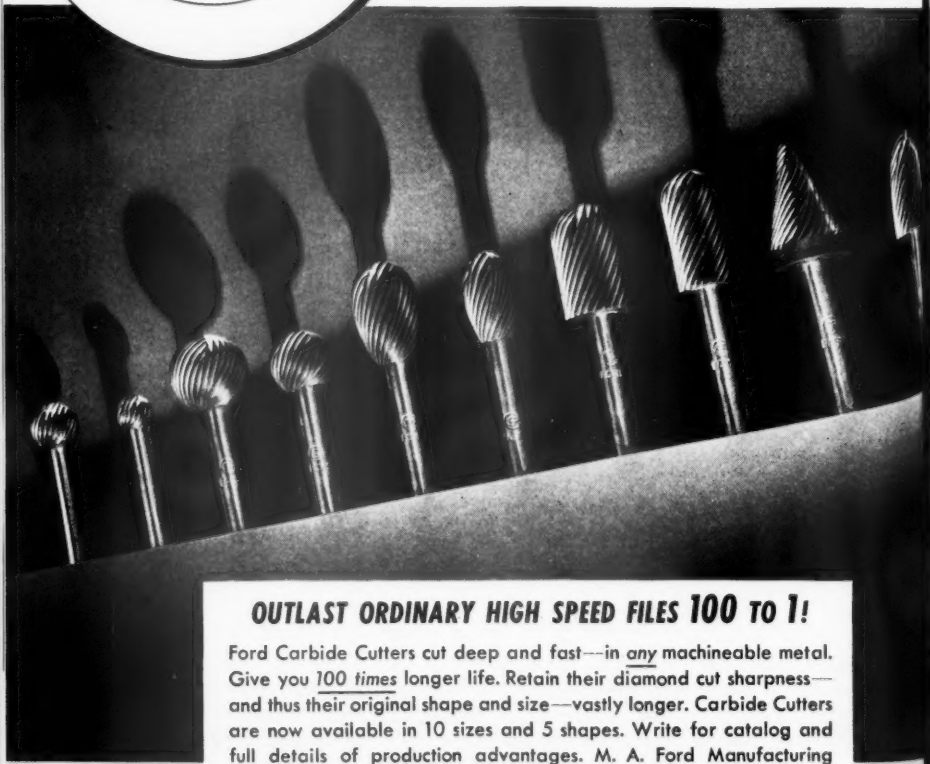
Ground from Solid
ROTARY CUTTERS

Hand Cut
ROTARY FILES

and Now...

Carbide Cutters

...A revolutionary NEW file for FASTER CUTTING in HARDER METALS!



OUTLAST ORDINARY HIGH SPEED FILES 100 TO 1!

Ford Carbide Cutters cut deep and fast—in *any* machineable metal. Give you *100 times* longer life. Retain their diamond cut sharpness—and thus their original shape and size—vastly longer. Carbide Cutters are now available in 10 sizes and 5 shapes. Write for catalog and full details of production advantages. M. A. Ford Manufacturing Company, Inc., 739 West First Street, Davenport, Iowa.

The Welding Equipment & Supply Company offers manufacturers a complete line of Eureka Tool Steel Welding Electrodes. They consist of 6 types, namely: 2 water hardening, 2 oil hardening, 1 air hardening, 1 hot working in sizes $\frac{1}{16}$" to $\frac{3}{16}$" inclusive. These EUREKA Welding Electrodes are used for the maintenance repair of your existing tools and dies as well as for the composite construction of new units. In addition to the above line there is available, Eureka "DRAWALLOY" Welding Electrodes for maintenance repair of forging dies and the creation of bearing surfaces. Write for our catalog and procedure manual which describes this complete line of EUREKA Tool Steel Welding Electrodes.

1. 72 Hot Working Electrodes
2. 70W Oil Hardening Electrodes
3. 75X Water Hardening Electrodes
4. 1215 Air Hardening Electrodes
5. 71M Oil Hardening Electrodes
6. 8510 Water Hardening Electrodes

DISTRIBUTORS IN PRINCIPAL CITIES IN UNITED STATES AND CANADA

DELIVERY

Immediate deliveries can be made on all sizes and types of Eureka Tool Steel and "DRAWALLOY" Welding Electrodes.

WELDING EQUIPMENT & SUPPLY CO.
223 Leib Street • DETROIT, MICHIGAN

Engineered Diamond Tools!

DESIGNED TO GIVE BETTER PERFORMANCE AT LESS COST *ON YOUR JOB!*

The accuracy, precision, dependability and long life built into diamond tools by Wheel Trueing Tool Company are the result of 33 years' experience in designing, developing and manufacturing diamond tools of fine quality. These tools are the products of an organization of diamond engineers unexcelled in skill and experience—craftsmen who know grinding wheels and the application of diamonds and diamond tools to all types of production jobs.

It is no wonder that more and more production men interested in faster and more economical production are specifying diamond tools engineered to their jobs by Wheel Trueing Tool Company.

★

DIAMOND TOOLS for

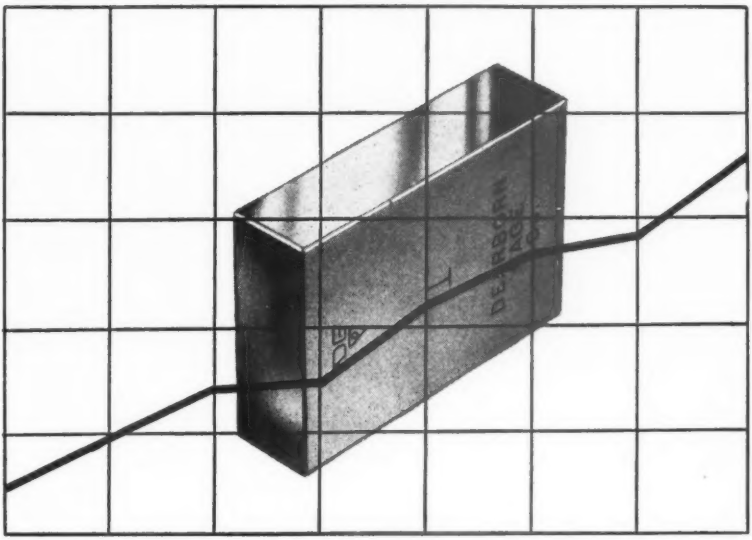
STRAIGHT, FORM, THREAD AND RADIUS DRESSING; TURNING, BORING, GAGING AND CORE DRILLING

★

WHEEL TRUEING TOOL COMPANY INCORPORATED

3200 W. DAVISON DETROIT 6, MICH.

WHAT *Chromium Plated* STANDARDS



. . . mean to your production line

DEARBORN'S Chromium Plated Gage Blocks are the standards of measure that are accepted by manufacturers for maintaining accuracies longer than the ordinary hardened steel blocks. This is particularly important now when the adherence to close tolerances is a "must". And it is important too, that these Dearborn Blocks can be used on production lines longer without replacements. Therefore, you can realize a definite saving on operation time when you know the blocks you use are Chromium plated to assure "Longer Wearing Millionths" and are unconditionally guaranteed for accuracy.

Yes, you can rely on Dearborn Gage Blocks—true they cost more but they are worth more!

DEARBORN GAGE CO. 22035 BEECH STREET DEARBORN, MICHIGAN

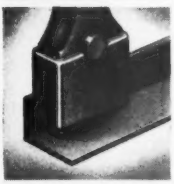
Originators of Chromium Plated Gage Blocks

STAMPS THE ENTIRE PART NUMBER AT A SINGLE BLOW!

THIS MERCURY TYPE HOLDER is the efficient solution to the *accurate* numbering of parts, *vitally* important in today's war production programs . . .

It stamps the *entire* part number—up to 16 characters if needed—with just one blow of the hammer. One setting of the part number in the Holder enables you to mark as many duplicate parts as desired—quickly, accurately and neatly. It eliminates inefficiency and time lost using single-character stamps for each separate figure or letter, and all of the errors common to this method such as overlapping, wrong sequence, etc.

In addition, Mercury Type Holders offer you these outstanding features that insure faster, better stamping operations . . .



◀ **Interchangeable Type**—Changing type is a matter of seconds and involves no special knowledge or equipment.

▶ **Fool-proof Operation**—Special design features make it impossible to incorrectly place type in Holder.

◀ **Compact Construction**—Smaller parts can be neatly numbered because of unusually compact Holder construction.

▶ **Durable, Trouble-Free**—All steel *machined* construction eliminates replacements and repairs.

Available complete with hardened and ground hand-cut steel type in all popular sizes and in special models to meet specific problems. Descriptive folder—mailed free—gives details and specifications for both hand and press style Holders. Write Dept. 9D for your copy.

MERCURY METAL DIE & LETTER CO., INC.

546 E. 16TH ST., LOS ANGELES 15, CALIFORNIA

Immediate Shipment
STEEL BOXES
FOR YOUR PRODUCTION NEEDS

STYLE 300 STACKING BOX

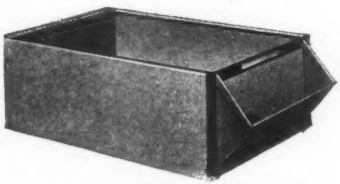
Just right for your small parts. Light in weight, easy to handle. Equipped with drop handle each end. Runners save wear on bottom of box and act as positive stacking lock.

No. 301	6″ x 9 ″ x 3½″	20 ga.	$ .55 Ea.
No. 302	8″ x 12 ″ x 4 ″	20 ga.	$ .60 Ea.
No. 303	9″ x 13½″ x 4½″	19 ga.	$ .75 Ea.

STYLE 600 STACKING BOX

An ideal all-purpose shop box. Sturdy all-welded construction. Heavy skids act as positive stacking lock and re-inforce box at point of maximum wear.

No. 601	10″ x 16″ x 6″	18 ga.	$ .95 Ea.
No. 602	12″ x 18″ x 8″	16 ga.	$1.25 Ea.



STYLE 500 STACKING BOX

Open front makes contents easily accessible when boxes are stacked. Will stack with Style 600 boxes.

No. 501	10″ x 16″ x 6″	18 ga.	$1.15 Ea.
No. 502	12″ x 18″ x 8″	16 ga.	$1.50 Ea.

STYLE 100 TAPER PAN

One piece, all-welded construction. Hook handle at each end. Will nest perfectly when empty.

No. 101	10″ x 18″ x 6″	18 ga.	$ .75 Ea.
No. 102	12″ x 20″ x 6″	16 ga.	$ .90 Ea.

AMERICAN METAL WORKS, INC.

1531 Germantown Avenue — Philadelphia 22, Pa.

SAVE PRODUCTION TIME *with a* SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.

MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 54" above floor and lowers to within 5½" of floor. Overall height 72". Size of platform 24"x24" wood deck. Crank, up and down, hoist unit.

Price

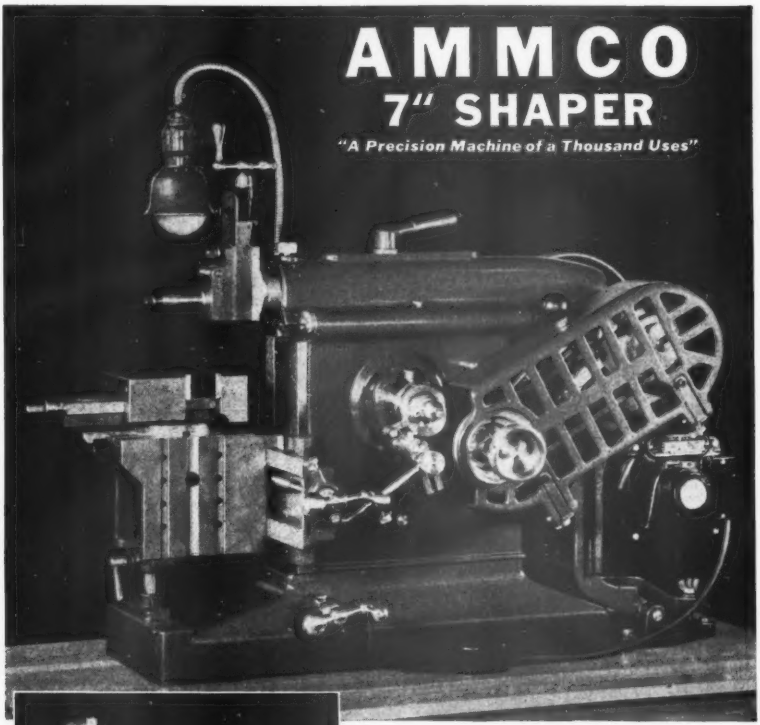
$147.50

ECONOMY ENGINEERING CO.

2659 W. Van Buren St., Chicago

IMMEDIATE DELIVERY

AMMCO
7" SHAPER
"A Precision Machine of a Thousand Uses"



IT'S PORTABLE

- **Saves time and steps!**
- **Can be moved from job to job in tool and die shop!**
- **Just wheel up to bench--plug in--and go to work!**

On jobs requiring a stroke of 7" or less, the AMMCO 7" PRECISION SHAPER will enable you to save a lot of time and expense in a set-up which would be required for larger shapers. Furthermore, the AMMCO will enable you to get away from the cost of operating a big shaper on small work.

Portable Cabinet model enables this shaper to be moved about the shop.

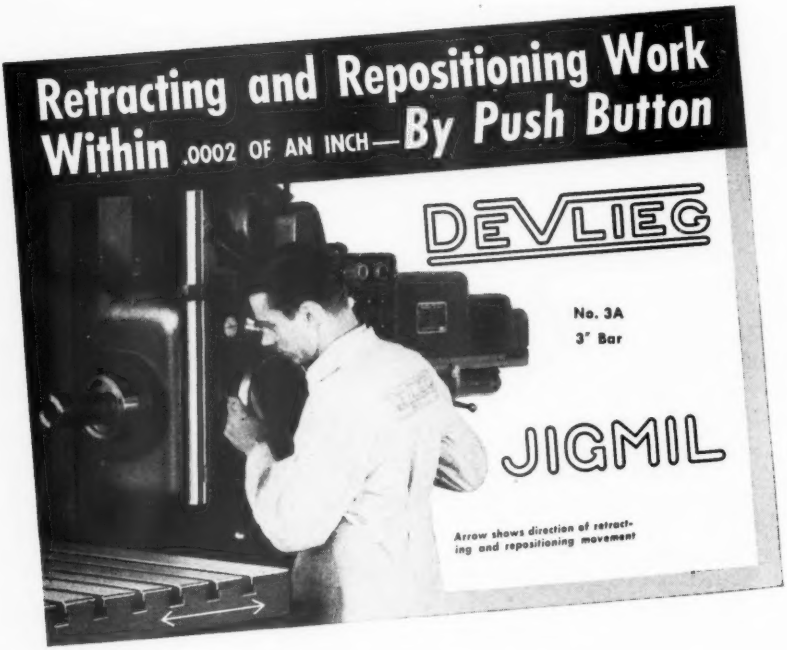
•

Write today for specifications and prices

ARMY E NAVY

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Ave.—North Chicago, Illinois, U. S. A.

Retracting and Repositioning Work Within .0002 OF AN INCH—By Push Button



The most frequently needed function in a precision boring machine is that of retracting the work to facilitate measuring and tool setting.

In the DeVlieg Jigmil, this function is automatic—by fingertip control. Operation of a push button unlocks the table and moves it by rapid traverse to the desired position for measuring. For repositioning, operation of a single push button will cause the table to return to its cutting position by rapid traverse, stopping and locking automatically. Uniformity of selected position for stopping and locking is dependable within .0002".

The DeVlieg Jigmil is a new type machine—has the spacing accuracy of a Jig Borer—Performance Qualities of a Milling Machine—Convenience and Flexibility of a Horizontal Boring Mill. All control is so centered and organized that the operator never has to take his eyes off the work.

Thus, the Jigmil fulfills the machine tool ideal—a powerful and accurate extension of the operator's hand.

Many machines show 75 per cent greater average daily productivity.

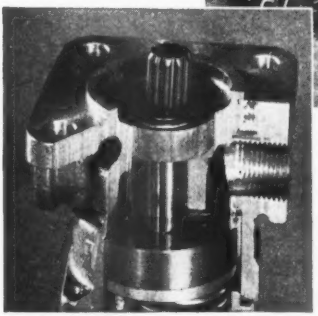
DE VLIEG MACHINE COMPANY
450 FAIR AVE. FERNDALE (DETROIT) MICHIGAN

Write for Circular
DEVLIEG MACHINE TOOLS

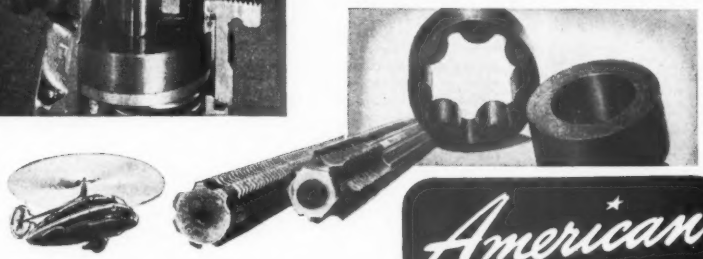
LINES BEHIND THE LINES

"PLENTY! RIGHT NOW!" IS THE AIRCRAFT INDUSTRY'S SLOGAN —FROM PRODUCTION LINES TO FIRING LINES WITH SPEED!

Confronted with the necessity of mass production, the aircraft industry quickly sought and quickly found new methods to machine precision parts at a production rate. Broaching is becoming more and more aviation's way of meeting split second schedules.



Broaching—a better way to do many metal working jobs — is the only *right* way to do some! Cutaway view of Eaton aircraft fuel pump (left) shows distinctive rotor principle, depending for efficiency on accurate fitting.



Teeth in outer rotor are broached on a standard American hydraulic broaching machine. American broaching tools, designed specifically for the task, provide high output at economical cost. American's *complete* broaching service—machines, tools, and engineering — makes war production more efficient, post-war production more profitable.

BROACHING IS BETTER THE *American* WAY

American
BROACH AND MACHINE CO.
ANN ARBOR, MICHIGAN
•
BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY
DIVISION OF

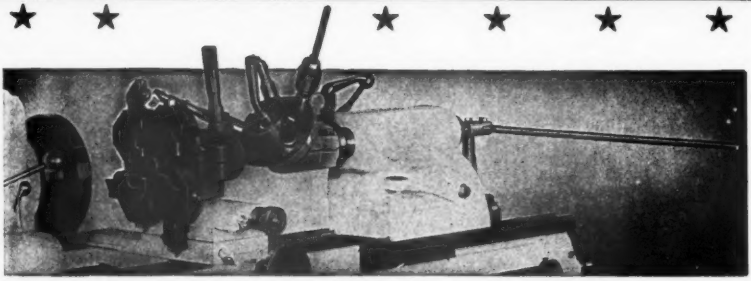
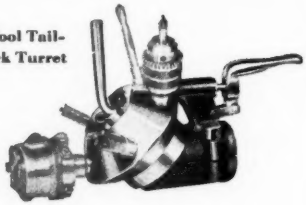


Photo above shows Jefferson Turrets on 16" lathe

Convert

YOUR ENGINE LATHE INTO A TURRET LATHE IN 15 SECONDS

5-Tool Tail-Stock Turret



Yes, it's as easy as that! You simply attach the Jefferson Tail-Stock Turret, the Jefferson Tool-Post Turret, and the Jefferson Adjustable Pull Feed to your lathes as shown in illustration, above.

The productive capacity of these machines will be more than doubled in many instances because there will be available at all times NINE DIFFERENT TOOLS.

With these three JEFFERSON time-saving devices attached to a lathe, any kind of work may be done, such as forming, roughing, boring, finishing, knurling, drilling, tapping, etc., without stopping the lathe, or changing tools. THE JEFFERSON TURRETS are made very substantial, rigid, accurate and in several sizes to fit small bench lathes up to 24" swing.

Pat. Pending

4-Tool Tool-Post Turret

We also Manufacture the Jefferson Bull Dog Precision Milling Machine. Obtainable Power or Hand Feed.

Delivery 3 weeks.

Jefferson Turrets are real production tools — substantial, rigid, accurate and adaptable to any size or make of engine lathes. They must not be confused with the small makeshift gadgets now on the market.

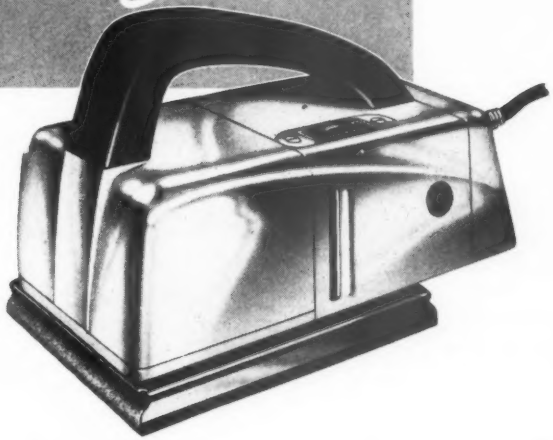
TURRET DELIVERIES IN 6 DAYS

Write for further details of these and other Jefferson time-saving machine tools and machinery.

JEFFERSON MACHINE TOOL CO.
710 N. Fourth St., Cincinnati, Ohio

Tool-Post Turrets, Tail-Stock Turrets, Adjustable Pull Feeds, Belt Sanders, Gyratory Foundry Riddles, Overhead Swing Frame Grinders, Milling Machines, Dividing Heads and Vises.

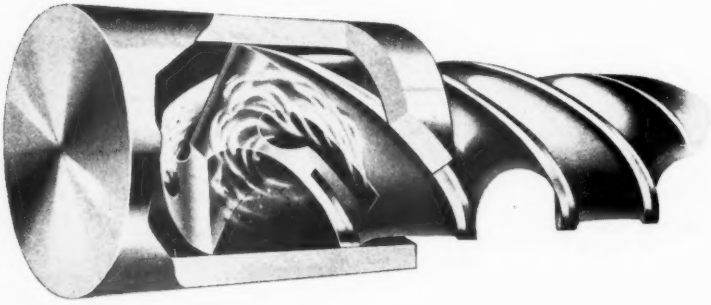
12 Advantages IN THE "NEDCO" Handi-Sander



1. Does perfect lapping, finishing and polishing.
2. Produces a handsome satinlike finish.
3. Smooth working, fast cutting, *vibrationless.*
4. Permits use of one or both hands.
5. Distributes pressure evenly to working surface.
6. Ball bearing construction yields full motor capacity.
7. No rubber parts in mechanism to wear out.
8. Abrasive quickly and easily changed.
9. Abrasive pads of different shapes—interchangeable.
10. Weight slightly less than eight pounds.
11. 8¾" long, 3½" wide, 6" high (overall dimensions).
12. Proven by long service in numerous fields.

Send for Bulletin

THE LINTERN CORPORATION
NEDCO DIVISION
24 LINCOLN AVE. BEREA, OHIO



See HOW YOU CAN SPEED UP DEEP DRILLING!

PROMPT SHIPMENT

●

All Size Oil Hole Drills from ⅜" to 3½" in diameter

The difficulties usually encountered in the drilling of deep holes with standard drills can now be entirely overcome by using a SUPER-KOOL Oil Hole Drill.

With this advanced type of drill, oil is forced through the shank, the entire length of the drill, direct to the cutting edge, thus making it possible to speed up drilling operations tremendously without endangering the tool through overheating.

The constant supply of oil at the cutting edge keeps the drill sharp much longer, thus resulting in smoother holes. At the same time, the pressure of the oil forces the chips back through the flutes, preventing them from accumulating at the cutting edge—the common cause of scoring.

The two oil holes, which follow the twist of the drill, are made by a patented method which tends to give the drill added strength. Because of its cooling feature, the Super-Kool has a life two to three times that of ordinary drills.

DETROIT REAMER & TOOL CO.
2830 E. 7-Mile Road Detroit 12, Mich.

SUPER KOOL
OIL-HOLE DRILL

Manufacturers of
Oil Hole Drills . . . . . Special Reamers
Circularity Relieved Reamers and End Mills
Also
Special Tools

33 years of precision workmanship and reliable service ...Sossner's reputation is your guarantee of satisfaction.

High speed, precision ground from solid stock in American National, full or modified Whitworth, and British Association threads.

ALSO: STEEL STAMPS • GAGES • CUTTING TOOLS

SOSSNER

161 Grand Street, New York City 13, or 27 Broadway, Lynbrook, N. Y.

SAVE YOUR MACHINES!

CUT WEAR AND REPAIRS
. . . STEP UP OUTPUT

Sutton Patented Diamond Grip Collets take horizontal and rotation thrusts at an angle and hold stock fast with 10% to 15% less locking tension—reducing strain and wear on machine and parts.

With slippage cut to practically zero, machine cycles can be stepped up to tool capacity—you get more pieces per hour.

Diamond Grip is self-cleaning . . . does not clog like ordinary, square-cut grip . . . you get less scrap . . . costs no more than ordinary collets.

See our representative or send for Catalog 15

SUTTON TOOL COMPANY
2895 W. Grand Blvd., Detroit 2, Michigan

SUTTON Diamond Grip **COLLETS**

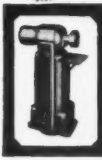
Protection at Home . . .

Protection of workers on the Home Front from production hazards, means increased output of vital war materials for our Fighting Forces.

The best equipment cannot be produced, unless machines and operators are coordinated for speed with accuracy and safety. LIMA GEARSHIFT DRIVES on your machine tools, assures you of flexibility in your production, with a maximum of speed and safety. Remember . . . there are thousands of new hands operating America's machines today . . . give them the best.

For *Speed, Accuracy and Safety* specify LIMA Gearshift Drives . . . Magnetic Polishing Lathes . . . Pedestal Grinders and Electric Motors. Immediate delivery on many sizes. Wire or write for address of Lima Engineering Service nearest you.

Large enough to successfully serve you, yet small enough to give personal attention to your needs.



THE LIMA ELECTRIC MOTOR CO.

866 FINDLAY ROAD

LIMA, OHIO

REPRESENTATION IN MOST PRINCIPAL CITIES

LIMA GEARSHIFT DRIVES - LIMA ELECTRIC MOTORS
LIMA MAGNETIC POLISHING LATHES - LIMA PEDESTAL GRINDERS

LONG RUN ECONOMY
ON
SHORT RUN JOBS!

NEW CUTTER *by Super*
BRINGS CARBOLOY TIPPED EFFICIENCY
to All Milling Jobs

Now you can get the money-saving efficiency of a Carboloy tipped milling cutter for your short as well as long runs! Made with a cast alloy body and the minimum number of flutes necessary for the specific work it is to do, this cutter, developed by Super Tool engineers, can be sold at such a low price in comparison with old type carbide tipped cutters that it can be used economically on short run jobs and even general shop tooling.

But low initial cost is only one of its many economies! It does more work, better work—faster! Run it at machine capacity with feeds of .002" to .005" per tooth in cast iron and non-ferrous materials! Run it at suface speeds of 400 to 800 feet per minute with tooth loads of .0005" to .0025" in steel. That's performance that spells EXTRA ECONOMY!

This cutter is accurate! Its faster operating speeds mean less cutting pressure—less work distortion. Much of the heat produced is thrown off in the chip leaving only a portion to be absorbed by the work and the cutter.

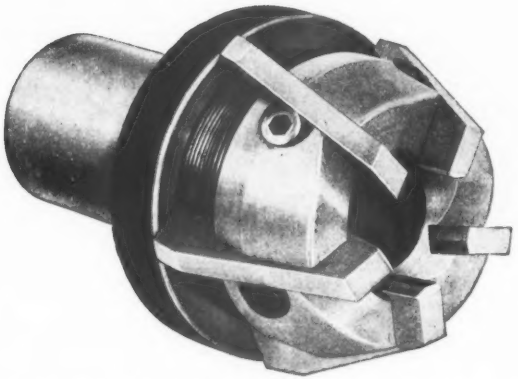
Available in 3" to 8" diameters with 4 or 6 flutes for cast iron, brass, bronze, copper, aluminum, magnesium, and plastics. For steel, 6 to 16 flutes are used according to the diameter. Let us send you a descriptive folder giving more details including prices.

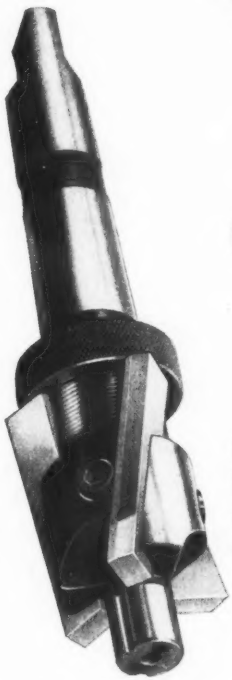
All sizes available for early shipment

SUPER TOOL COMPANY
Carbide Tipped Tools

21650 Hoover Road, Detroit 13, Michigan ★ 4105 San Fernando Road, Glendale 4, California

GENESEE ADJUSTABLE HOLLOW MILLS





(Style H Facing & Counterboring Tool)

Cut Cost—Increase Production

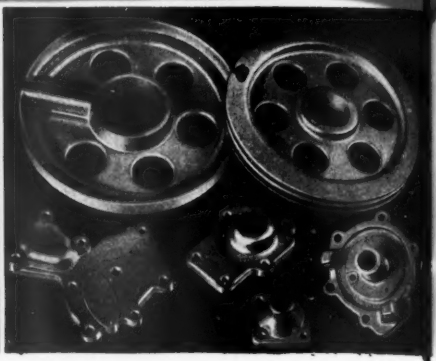
with GENESEE inserted blade—
ADJUSTABLE HOLLOW MILLS
FACING & COUNTERBORING TOOLS
SPECIAL PRODUCTION TOOLS

Backed by 35 years experience our Engineering Department is always ready to serve you in your Production Tool problems.

◆

Write for complete Catalog No. 42-H

GENESEE
Manufacturing Co., Inc.
Rochester 4, N. Y.

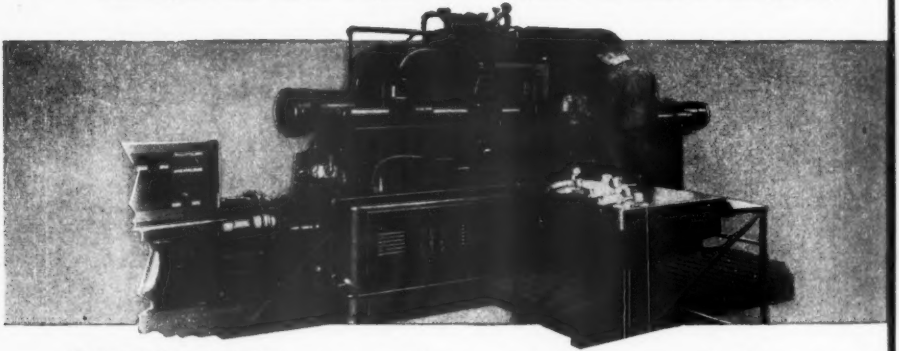


AUTO-LITE takes pride in producing aircraft die castings that are "Denser .. Stronger .. More Uniform"

Above you see a few examples of the many aircraft parts produced by the Alemite Die Casting Division of Electric Auto-Lite Co.

This organization makes a specialty of providing *the densest, strongest and most uniform die castings obtainable.*

Many parts must pass 100% X-ray inspection for freedom from porosity.



AUTO-LITE uses a large battery of the most modern *Super Pressure* Die Casting Machines

Above is one of Auto-Lite's Lester-Phoenix Die Casting Machines. The metal can be injected at pressures of 22,000 to 30,000 psi.

This calls for a machine *built to confine these extremely high pressures to the die cavities.* The Lester-Phoenix has a non-elastic beam type cast steel frame, with 360% greater sectional area for holding the dies closed. Also quicker die adjustment, automatic electric timing, and other exclusive features.

Write us for help in improving *your* die castings. Our experience as pioneers in high-pressure injection is yours for the asking, without obligation. Send us a print of any die cast part—or better yet, send us a sample.

(Did you get a copy of "Factors to be Considered in Designing Die Castings," by Herbert Chase? We will be glad to send you one—write us).

LESTER-PHOENIX, INC.

2711 CHURCH AVE., CLEVELAND 13, OHIO

LESTER-PHOENIX

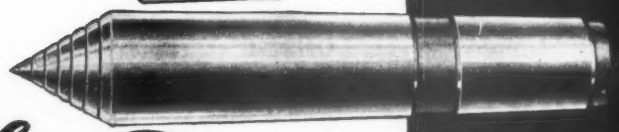
DIE CASTING MACHINES

HIGHER PRESSURES *make* STRONGER CASTINGS

for CLOSE TOLERANCES

RIGID SUPPORT
No balls, rollers, or races to wear out and cause uneven tooling.

BETTER LUBRICATION due to exclusive helical groove★



Use CMD *Helical Groove* CENTERS AND CMD CENTER POINT OIL

★ The exclusive left hand helical groove in CMD Centers holds a reserve supply of lubricant and conveys it constantly to the extreme point of center. No burned out centers! No stopping machine to relubricate centers!

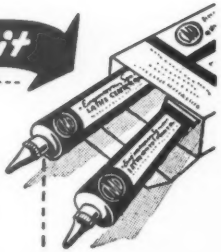
When CMD Helical Groove Centers are used with CMD Center Point Oil, they can be drawn up tight against the work, permitting closer tolerances and finer precision results. Send coupon now for details and FREE sample kit of the oil.

Write for FREE *Sample Kit*

CHICAGO MANUFACTURING & DISTRIBUTING CO.
Dept. 10J, 1928 West 46th St., Chicago, Ill.

☐ Send circular on CMD Helical Groove Centers
☐ Without obligation to us, send FREE sample kit containing a tube of CMD CENTER POINT OIL and a tube of CMD CENTER POINT LUBE (grease) with directions for making an amazing, simple test.

NAME .....
FIRM NAME .....
ADDRESS .....

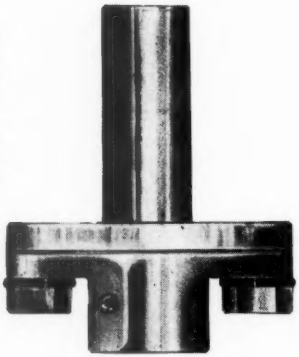


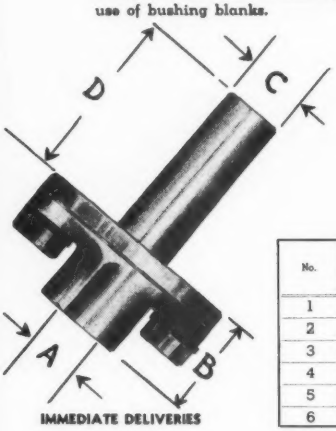
FLOATING HOLDERS

for

SCREW MACHINES

Made of forged steel and finished to precision tolerances — they are excellent for holding drills, reamers and counterbores in the turret of automatic and hand screw machine, allowing the tool to float for concentricity with the work. Quickly interchangeable for smaller tools by the use of bushing blanks.





IMMEDIATE DELIVERIES
ON PRIORITY

Specifications

No.	A Diameter of Hole for Tool in Inches	B Length of Body in Inches	C Diameter of Shank in Inches	D Length of Shank in Inches	Price Each	Bushing Blank Price Each
1	1/2	27/32	5/8	1 1/8	$ 6.00	.55
2	5/8	1 1/8	3/4	2	6.25	.55
3	1	1 1/2	1	2 1/2	7.95	.65
4	1	1 1/2	1 1/4	3	8.65	.65
5	1 1/2	2 19/32	1 1/2	3 1/4	15.00	.85
6	1 1/2	2 9/32	1 3/4	3	20.00	.85

The above specifications chart provides an easy and efficient way to order.

AJAX ENGINEERING & MFG. CO.

Designers and Builders of Fine Machine Tools

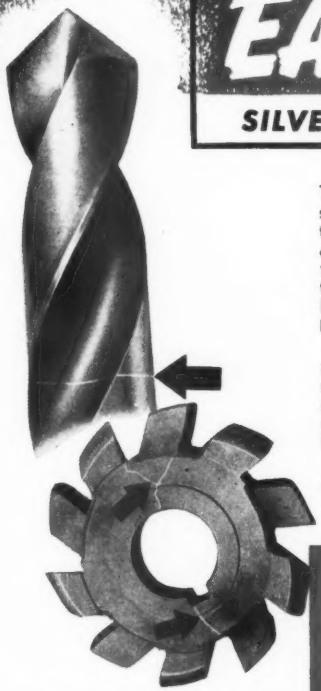
1947 EAST KIRBY — Telephone PLaza 2536 — DETROIT, 11 MICHIGAN

Don't scrap broken tools!

—get them back in action quick with a few cents worth of . . .

EASY-FLO

SILVER BRAZING ALLOY



There's seldom any need to scrap even badly shattered tools today, for you can restore them to good-as-new working condition in quick time and at a small fraction of their replacement cost — with EASY-FLO. It's EASY-FLO's low working temperature, exceptional free-flowing quality and high-strength of joints that make possible this fast, inexpensive tool repair.

Industry's grapevine is passing along this good news and already hundreds of manufacturers are saving days of delay and hundreds of dollars by repairing cutters, broaches, punches, dies, taps, drills and many other valuable tools, the easy EASY-FLO way.

BULLETIN 12-A gives details. Write for your copy now.

Two typical examples of EASY-FLO restorations. Broken surfaces of the 3⅝" diameter drill were simply ground flat and butt-brazed with .003" EASY-FLO strip preplaced. The Cutter was torch-brazed at a few cents cost in alloy. Anyone who is handy with a torch can do it.

-AND HERE'S YOUR FAST, RELIABLE, LOW-COST WAY TO MOUNT CEMENTED CARBIDE TIPS

EASY-FLO No. 3

makes a clean union between tips and tool shanks that has one-piece strength. Its low temperature makes overheating easy to avoid. Leading carbide tool tip manufacturers recommend it. Full instructions in Bulletin No. 11. Copy on request.

ARMY E NAVY

HANDY & HARMAN

HANDY & HARMAN FOUNDED 1867 QUALITY SERVICE

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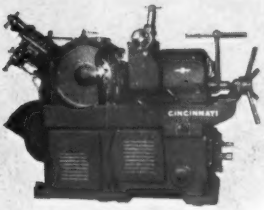
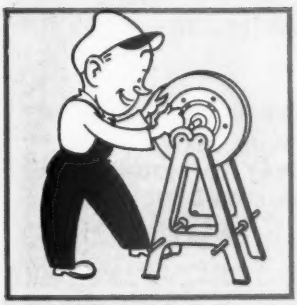


CINCINNATI No. 2 Centerless Grinding Machine. Complete engineering data may be obtained by writing for catalog No. G-456-1.

2% PAYS 98% PRODU

• Time out from actual production for routine service attention may seem like an unwarranted interruption, but its just as essential as the operator's personal fitness program. The urgency rating of production must never crowd out the still small voice of attention . . . attention to details of service that keeps the machine running . . . attention that keeps the machine producing during 98% or more of the normal working hours.

The CINCINNATI No. 2 Centerless Grinding Machine, for example, is a "bear" for work, but it, too, re-



Balance new grinding wheels; and worn ones, too, for the wheel may lose its balance as its diameter wears down. A good time to rebalance is when the wheel mount has been removed for cleaning the slinger grooves.

Remove wheel mounts once a week, wipe the slinger grooves clean, and clean out the drain hole. (Both regulating and grinding wheels.) This will prevent water and grit from contaminating the spindle oil.

THE CINCINNATI MILLING MACHINE CO.

TOOL ROOM AND MANUFACTURING MILLING MACHINES . . . SURFACE BROACHING MACHINES . . . CUTTER SHARPENING

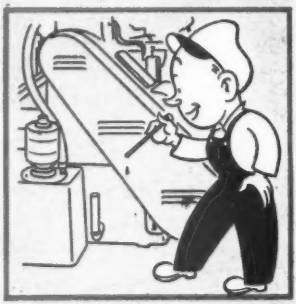
ATTENTION
TION DIVIDENDS

quires routine service attention to keep going. Some of the more important items are illustrated at the left. If you will consider the time required for these chores, you will find that it takes no more than about 57 minutes of a 56 hour week. In other words, **two percent of the operator's time spent in routine service attention keeps the machine producing the remaining 98% of his time.**

Why not give your Centerless a break. Don't begrudge it that 2% service attention, and you'll find that its always on the job ready to produce.

Stop machine before changing regulating wheel speeds. This will save wear and tear on the gears and chain.

CINCINNATI



Lubricate machine and check oil levels daily. Use lubricants specified in service literature and on machine instruction tags. Slides on machines *for high production infeed work* should be wiped clean, moved full length, and lubricated twice each shift.

CINCINNATI GRINDERS INCORPORATED CINCINNATI, OHIO, U.S.A.

MACHINES . . . CENTERTYPE GRINDING MACHINES . . . CENTERLESS GRINDING MACHINES . . . CENTERLESS LAPPING MACHINES

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CONTRACT TOOLING AND PRECISION PARTS DESIGN AND MANUFACTURE

A STAFF of capable engineers with broad industrial experience and an organization of highly skilled craftsmen and machine operators.

Our inspection is comprehensive and dependable. We have installed practically every type of needed instrument.

Our supervisory staff has had an important part in war products tooling and precision manufacture, which with a total of 23 years of general contract shop service, we believe qualifies us for your consideration. Our capacity is large and we have portions of it available from time to time.

We invite your inquiries.

Chamber of Commerce award as the best small industrial plant completed in 1941-42.

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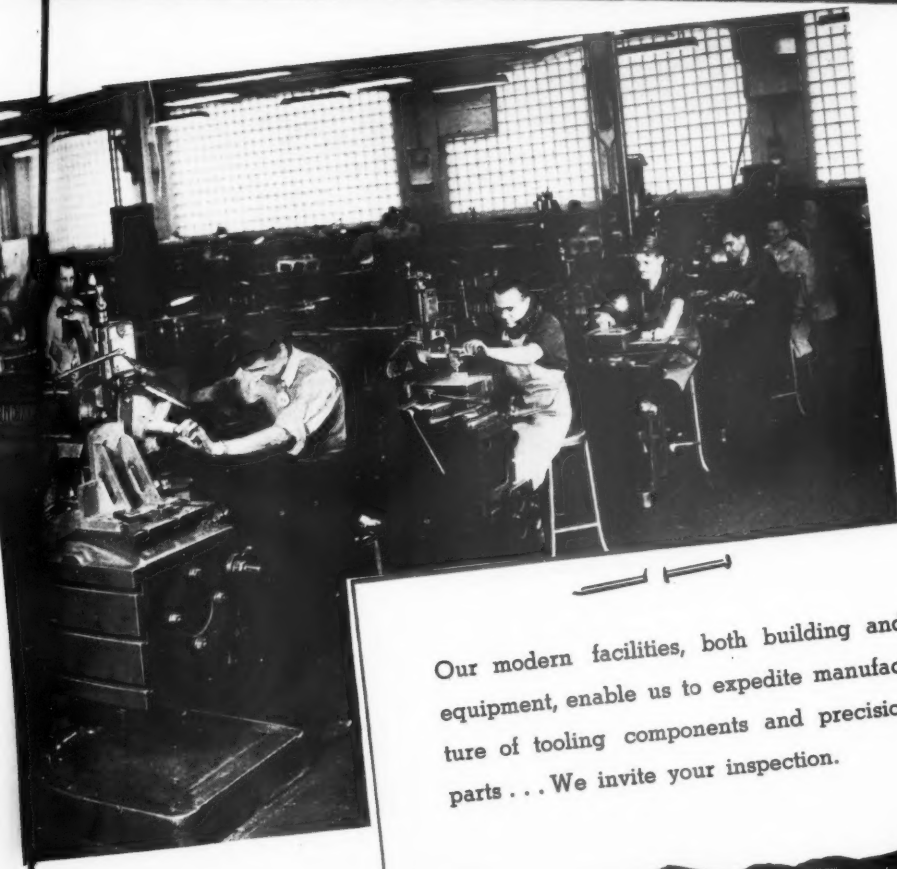
HAS WHAT IT TAKES TO DO YOUR JOB RIGHT

. . . at the right price



Our modern facilities, both building and equipment, enable us to expedite manufacture of tooling components and precision parts . . . We invite your inspection.

DESIGNERS AND MANUFACTURERS OF

Tools • Special Machinery • Dies • Jigs • Gauges • Fixtures

PRECISION PRODUCTION OF PARTS AND ASSEMBLIES

Flying High

Broaching a three blade propeller hub in the Lapointe 4L variable speed Hydraulic Broaching Machine.

Flying high like a song on the wing goes the smooth effortless flow of power in the air. Like the quill from an angel's wing — like stardust on the moon — like a dream for the future — is the romantic story of broaching today.

Just as the broach turned the horseless carriage into the family runabout, so also is broaching turning the flying chariots into dependable mass produced precision birds of flight.

ARMY E NAVY

The LAPOINTE Machine Tool Company

HUDSON, MASSACHUSETTS, U. S. A.

HERE'S A BETTER, FASTER WAY TO SPEED THE BURRING OF HOLES!

NOBUR

burr-removing tool has these EXCLUSIVE features!

1. NOBUR works like a drill—can be used in spindle of any machine—operator works with complete safety!

2. NOBUR's double-edged cutting blade instantly removes burrs around holes in flat or curved surfaces of single or multi-walled parts—smoothly and accurately.

3. NOBUR eliminates slow, costly hand methods of burring holes—speeds production—parts can be burred as fast as they can be handled by the operator.

4. NOBUR stops waste of vital materials—eliminates reworks and rejects in assembly—cuts burring time to an absolute minimum and makes the burring of holes a machine operation.

5. NOBUR is available in 1/16" progressive sizes from 3/16" to 1" diameter.

NOBUR definitely increases the production of finished parts! Write today for complete information!

WORK
CUTTING BLADE
NOBUR TOOL

Note how readily NOBUR is used to burr curved surfaces.

Multi-walled part is easily and quickly deburred on all surfaces.

NOBUR MANUFACTURING COMPANY
908 NORTH ORANGE DRIVE LOS ANGELES, CALIFORNIA

DETROIT DIE SETS ★

SEMI-STEEL and ALL-STEEL STANDARD DIE SETS

SPECIAL DIE SETS

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DOWEL PINS

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HEADQUARTERS FOR SPECIAL DIE SETS

Come to headquarters for your special die set requirements.
We are especially well equipped and qualified to make special die sets to your specifications and we spare no effort to give you prompt service.

Send us your prints and instructions. Your inquiries will be answered by return mail.

STEEL PLATE—*fabricated or machined to your specifications.*

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Send for catalog.

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Sales and Service Offices in—NEW YORK • PHILADELPHIA
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Add to the life of your tools . . .
. . . at lower cost . . . with the substantial, accurate
DELTA Toolmaker Surface Grinder

"A heck of a lot of machine for the money," say delighted users . . . .

You make a big saving on initial cost — and get dependable, trouble-free results over a long, useful life—with this husky, big-capacity grinder. It is ideal for surface grinding, tool sharpening, etc.

Designed for speed and ease of operation. Convenient controls . . . wide graduations on micrometer for close settings . . . unique wheel adapter that saves on "truing-up" operations . . . many other features that assure you of creditable performance.

Call your industrial distributor (Delta sells only through distributors) today. Write for catalog. M-4CC

Specifications

Heavy enough for production work (over 6 feet high, weight close to 700 lbs.).

Wheel 7 x ½, 1¼" bore; minimum cup wheel 3½" dia.

Capacity (under 7" wheel) 9½" to table — 6" to Brown & Sharpe No. 510 Magnetic Chuck (not furnished).

Maximum surface that can be ground: Length 13½", width 6" (table surface 5¾ x 13). Hand operated.

Traverse feed, one graduation is .001".

Coarse vertical adjustment (wheel at top left), 9½" range.

Micrometer adjustment ⅜" range, each graduation is .0005".

Two spindle speeds: 3200 or 4200 r.p.m. with 60 cy. motor.

No. 24-105
$295.00 f.o.b. Milwaukee without wheel, motor, or switch. PD-1A priority required.

Tear out and mail coupon today!

THE DELTA MANUFACTURING CO.
612L E. Vienna Ave., Milwaukee 1, Wis.

Please send me your new catalog giving full details on the Delta Toolmaker Surface Grinder and your full line of low-cost machine tools.

Name_____ Position_____

Company_____

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DELTA MILWAUKEE Machine Tools

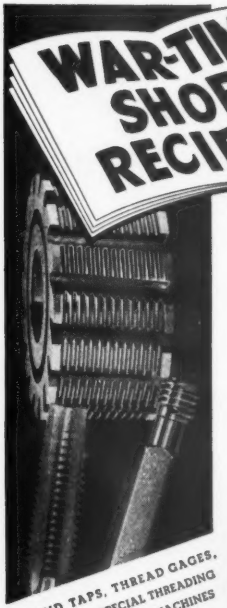
Drill Presses — Grinders — Cut-Off Machines — Band Saws — Abrasive Finishing Machines

DELTA CHIP-BREAKER GRINDER

Grinds the chip-breaker groove on carbide-tipped tools — also serves, with a quick adjustment, as a regular surface grinder. No. 24-205 including Univise and coolant attachment, $343.50 without wheel, motor or switch.

ARMY E NAVY

THE ARMY-NAVY "E" — *awarded for excellence in the production of machine tools vitally needed in the war effort.*

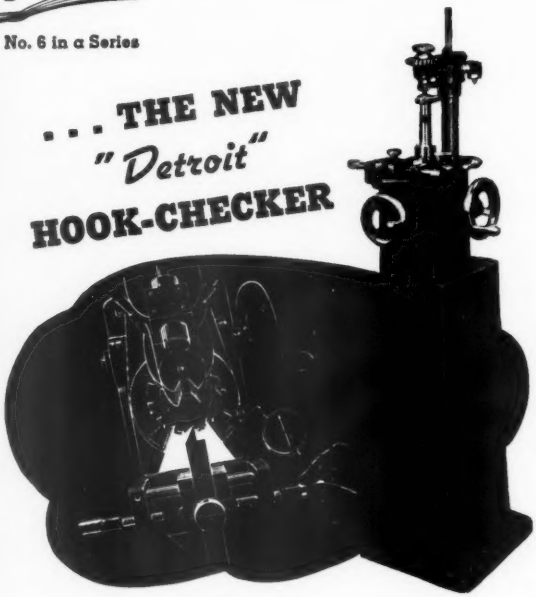


WAR-TIME SHOP RECIPES

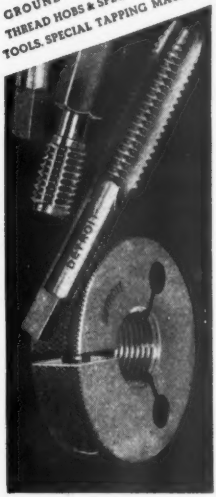
No. 6 in a Series

TO CHECK YOUR THREAD HOBS FASTER . . . . .

. . . THE NEW "Detroit" HOOK-CHECKER



GROUND TAPS, THREAD GAGES, THREAD HOBS & SPECIAL THREADING TOOLS. SPECIAL TAPPING MACHINES



Designed by Detroit Tap and Tool Company to speed production checking of its own thread milling cutters, this new universal hook-checker is being made available to industry generally.

It does not require special setting up for each 'hob'. All you do is slip the cutter between centers, bring a knife edge against the ground side of the sharpened face, by turning a micrometer until you can't see light between the two. Read the 'mike'. A convenient table then tells you whether the cutter is right or how much it is off. A dial tells whether flutes are correctly spaced.

Ask for bulletin No. HC-43 covering this new checker. It also gives useful hints as to sharpening of thread milling cutters.

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DETROIT TAP & TOOL CO.

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MICH. U.S.A.

Use

COLMONOY

HARD FACING ALLOYS AND OVERLAY METALS

Your production schedules would be mighty easy if your equipment never wore out.

When machinery wears to the point that it is useless for its particular function, you will find that the wear is localized—one place wears out before the rest.

Coat these critical places with the proper grade of COLMONOY. The application is easy to make, by standard welding methods. You will find that parts so treated will give service many times as long as will uncoated parts. Worn and discarded equipment, when hard-faced with COLMONOY, not only go back to work, but they will outwear and outperform new, uncoated equipment.

Our new Catalog No. 75 gives full information on all grades of COLMONOY and shows pictures of many types of application in different industries. Write for your copy today.

Catalog No. 75
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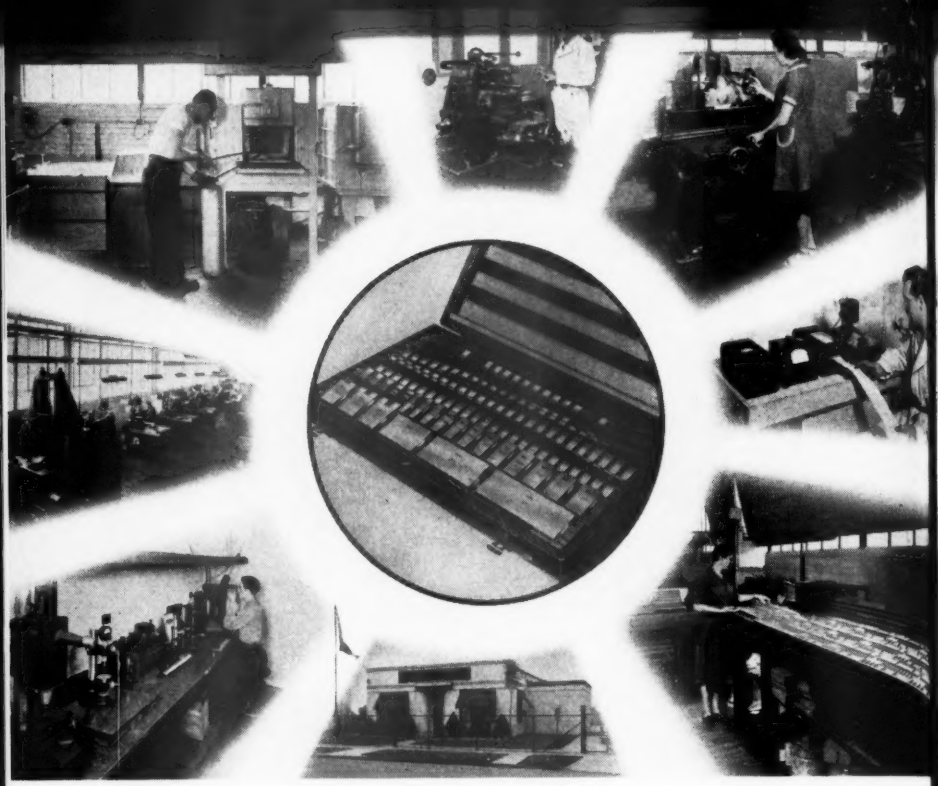

The Science of Precision Gage Making

WEBBER GAGE COMPANY

● Over a long period of years the growth of the Webber Gage Company has been constant. Today in a plant designed, built and equipped for the rapid production of precision gage blocks Webber has become the largest exclusive manufacturer of gage blocks.

Illustrated are a few random shots of operations and modern equipment used in the manufacture of Webber Gages and some of the precision instruments used for testing them.

Here you get a glimpse of the painstaking care taken at various steps in the manufacture of the gages from heat treating to shipment.

It has always been the Webber policy to maintain the most up-to-the-minute equipment for production and most modern instruments for testing.

Now manufactured in this air conditioned plant — tested in temperature controlled rooms Webber offers the ultimate in precision gage blocks.

Make your next set of blocks Webber Gages.

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NOW MANUFACTURED BY THE
SIEWEK TOOL DIVISION
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● For nearly a quarter of a century the name "Progressive" has been a buy-word for end mills of quality and dependability. Now the Progressive line of end mills is being manufactured by the Siewek Tool Division of Domestic Industries, Inc. There has been no change in the high character of the product, no change in the family of skilled workers, many of whom have been with the company almost from its inception. The only change between Progressive end mills of today and those of yesteryear has been the addition of the wider resources of Domestic Industries, Inc.,—an addition which brings added manufacturing facilities and improved customer service.

SIEWEK TOOL DIVISION
OF DOMESTIC INDUSTRIES, INC.
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JIGS
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and SPECIAL MACHINES

Affiliated with
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progress is non-stop . . .

American production, with the brakes off, is helping to produce the Victory. Then comes Peace. With it, world markets are only sixty hours from your shipping room door. Mr. and Mrs. China, Russia, Australia, India, Europe, South and Central America will have hospitable homes for the USA-made products of Peace. But don't let us kid ourselves. More and better goods for these millions must be made available for less. This in the face of high wages. A paradox? Hardly. Cost per unit goes down as production per man goes up. Pay more. Produce more. Sell more. Simple as ABC. Old, worn machine tools cannot produce efficiently, not efficiently enough for the products of the Peace World. Think about re-tooling now, for then.

THE R.K. **LeBLOND** MACHINE TOOL CO., CINCINNATI, 8

time to retool
Turn to LeBlond for Turning Equipment
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

ARMY-NAVY LEBLOND

Check-Clip-Mail
FOR ILLUSTRATED SPECIFICATIONS:
- ☐ HEAVY DUTY GEARED HEAD ENGINE LATHES
- ☐ TOOL ROOM LATHES
- ☐ AUTOMATIC LATHES
- ☐ HEAVY DUTY GEARED HEAD GAP LATHES
- ☐ SUPER REGAL GEARED HEAD LATHES
- ☐ RAPID PRODUCTION LATHES
- ☐ AUTOMATIC CRANKSHAFT LATHES
- ☐ No. 2 CUTTER GRINDER

YOUR NAME _____ TITLE _____
YOUR FIRM _____ ADDRESS _____

LEBLOND BRANCH OFFICES
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NEW YORK 13, 103 Lafayette St. CAnal 6-5281

Your Bonds Buy Bombs
Buy a *Today*

L:I *reamers for best results.*

EXTREME ACCURACY

Because the flutes are ground from the solid, the L&I process eliminates the distortion of flute structure that frequently occurs in the heat treating of small diameter, milled-flute reamers.

LONGER USEFUL LIFE

L&I reamers are carefully lapped after the flutes have been ground.

SMOOTHER SURFACE FINISH

L&I reamers have a cutting edge that is keener because it is ground on both faces.

LAVALLEE & IDE, INC.

CHICOPEE, MASS.

L:I

Take the short cut when ordering the supplies you must have quickly

...telephone your I S D First!

Of course you *can* go "all the way around" when buying the volumes of parts and supplies you must have to keep going. But why take the *long* route? Concentrate your business with your Industrial Supply Distributor—*he* draws upon many sources in order that *you* may purchase from one.

He buys on the highest available priorities—he buys as often as he can—he buys as much as he can get—to cover your own and his other customers' needs. Sometimes he doesn't even notify you until the goods are in, or enroute from the factory—so that whenever possible, he may fill your order the day you phone it in.

Order through your local source and eliminate costly duplications of time and work. Telephone your Industrial Supply Distributor *first!*

ARMY NAVY — ARMY E NAVY

The CLEVELAND TWIST DRILL COMPANY
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CLEVELAND DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

THE FIFTH FREEDOM

EACH week brings new and encouraging indications that American business men are coming to a greater realization of the need for the broad-visioned action which will protect their business interests.

A case in point is the organization of the National Tool and Die Manufacturers Association last week in Chicago. The declared purposes for such organization are not alone the "general development and improvement of the tool and die industry" but also include taking part "in any lawful movement or enterprise which . . . . will tend to preserve and promote the best interests of the United States of America and the American System of Industry."

It must be evident to every man who operates an industrial plant or who has capital invested in business, large or small, that the relative values of its components are now, and have been for some years, in a state of transition. More and more the emphasis is upon the value of labor and its contribution to the productive process and less upon the value of capital and its management.

For the thinking man the principle involved, that of placing the value of labor on a higher basis, is of itself not a threat of serious unbalance to our economic structure, for higher wages increase and broaden purchasing power and subsequently expand industrial production.

We call our business philosophy Free Enterprise and we point to the American Way of Life as proof of its rightness. That we are justified in this can be shown by comparing our standard of living with that of any other nation. In periods of prosperity under our economy, a larger proportion of our people participate in the increased earnings; there is a much wider spreading of both business profits and wages. In foreign countries, with business and trade either governmentally subsidized or monopolistically operated, or both, a large proportion of the profit accrues to the few.

In consideration therefore, of the advantages which our Freedom of Enterprise has built up for us, it is startling to read such a statement as that made by Louis Ruthenberg, president of Servel, Inc., and likewise of the Indiana State Chamber of Commerce, at the fiftieth annual meeting of the California Gas Association that "arrogant capitalism" is itself responsible for what many business men sincerely believe is an organized effort to discredit it. Regardless of whether or not this is true, it is

a tremendously hopeful state of affairs when business executives can voice such opinions for the consideration necessary to bring forth either needed correction or justifiable defense.

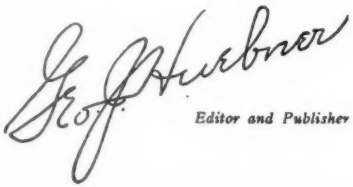
Mr. Ruthenberg's remedy is the "abandonment of privilege as a goal" and the acknowledgment by industrial management that its responsibility extends in three directions—the customer, the worker, the stockholder. Thus, he believes, can our Freedom of Enterprise be assured for the future.

We hear much about the *Four* Freedoms. The first two, Religion and Speech, are guaranteed to us by the Bill of Rights. Freedom from Want and Freedom from Fear cannot be guaranteed to us by anyone—not even the government of our own United States—we can only make them possible by sound economic policies. One of the principles which must be a part of such policies is the right or freedom of every man to engage in a business of his own choosing as he accumulates or otherwise legitimately acquires the needed capital. Equally important is the right or freedom of every man to obtain employment where and as he will at an agreed wage.

This is the principle of Free Enterprise and why isn't it our Fifth Freedom, to be just as jealously cherished and earnestly developed as the other four?

Who will deny that Free Enterprise built the American System of Industry? Rightfully and conscientiously carried onward it should assure to every industrious citizen and his family freedom from want. It may not bring release from all fear but it cannot be denied that freedom from want accomplishes much in that direction.

Freedom of capital and of labor are essential to the development and maintenance of the American Way of Life. Therefore, it is not only highly significant but most encouraging when the representatives of an important industry employing highly skilled, well-paid workers declare their intention of preserving and promoting our Country's best interests. It required a global war to prove to the world that Americans are the greatest and most resourceful industrial producers. American Industry had proved before the war that it can at one and the same time pay the world's highest wages and operate profitably. Its admitted responsibility after the war will be to provide more employment for more people.



Editor and Publisher

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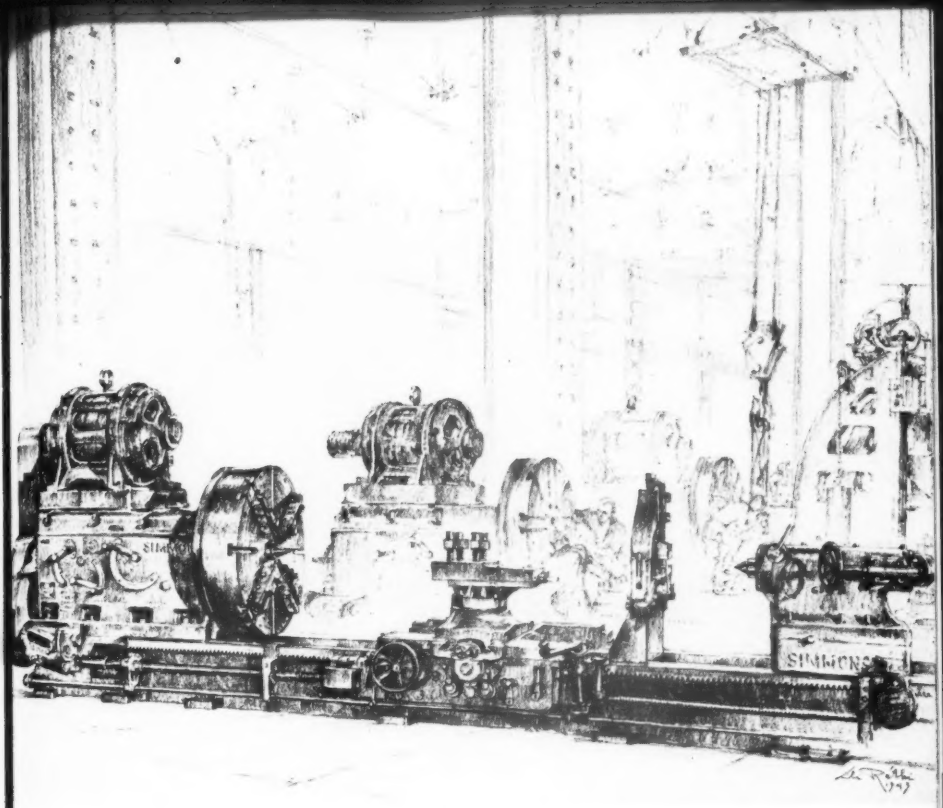


SIMMONS LATHE DRAWN BY LILI RETHI

IN these strenuous days of high pressure war production with their sometimes seemingly insurmountable obstacles, bottlenecks and worries all around the clock, a truly refreshing breathing spell is afforded in sitting back for a few moments' enjoyment of real art in our chosen field.

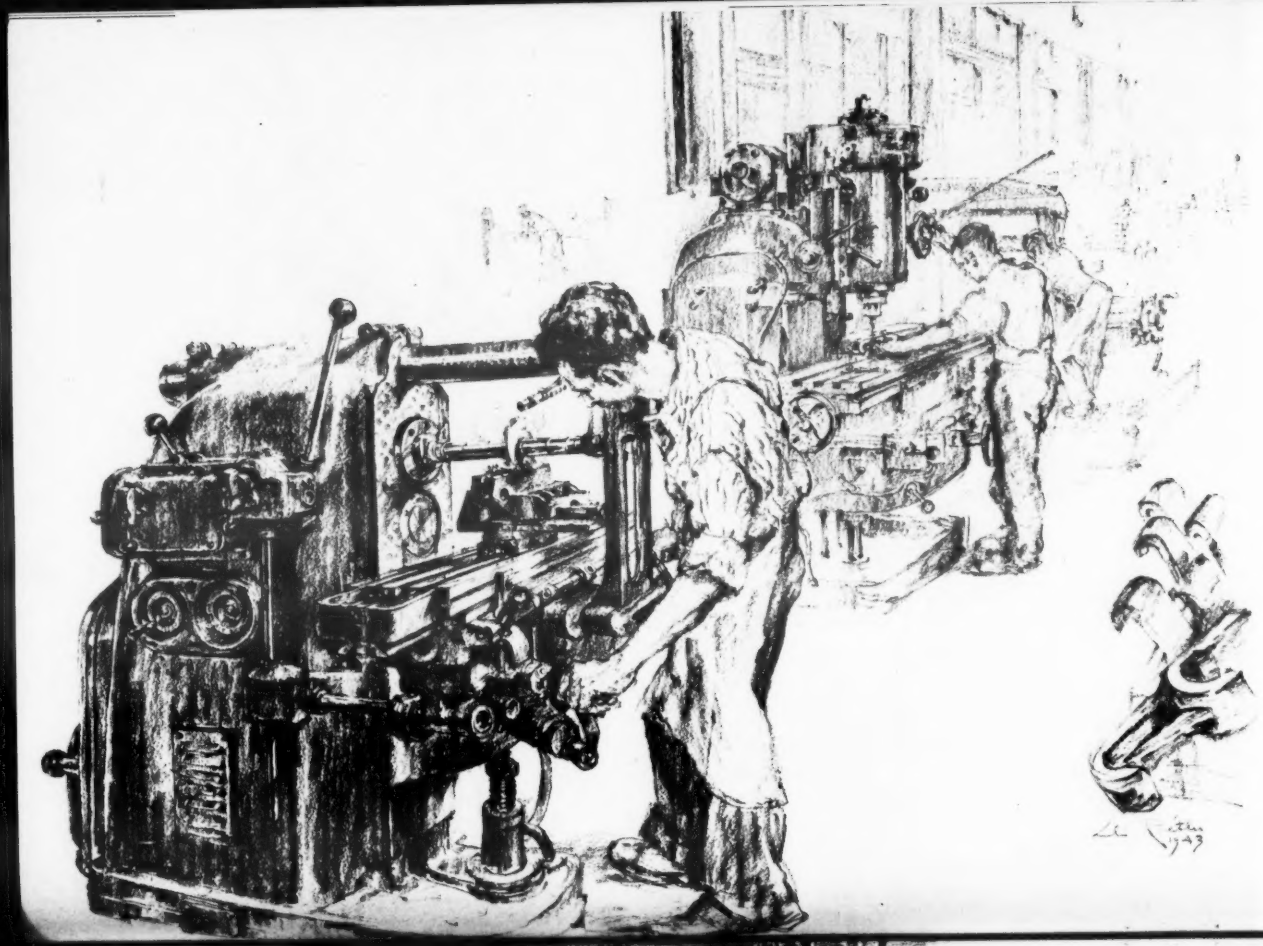
We are particularly pleased therefore to present to our readers these inspiring examples of the work of the Viennese artist, Lili Rethi, who has been so successful in her handling of subjects of interest to engineers and architects. She has been in America since 1939 and her work has already had the rare distinction of being exhibited in the Metropolitan Museum of Art.

Miss Rethi recently spent a fortnight at the plant of the Simmons Machine Tool Corporation and executed seven pencil drawings, five of which we are privileged to reproduce for our mutual enjoyment.

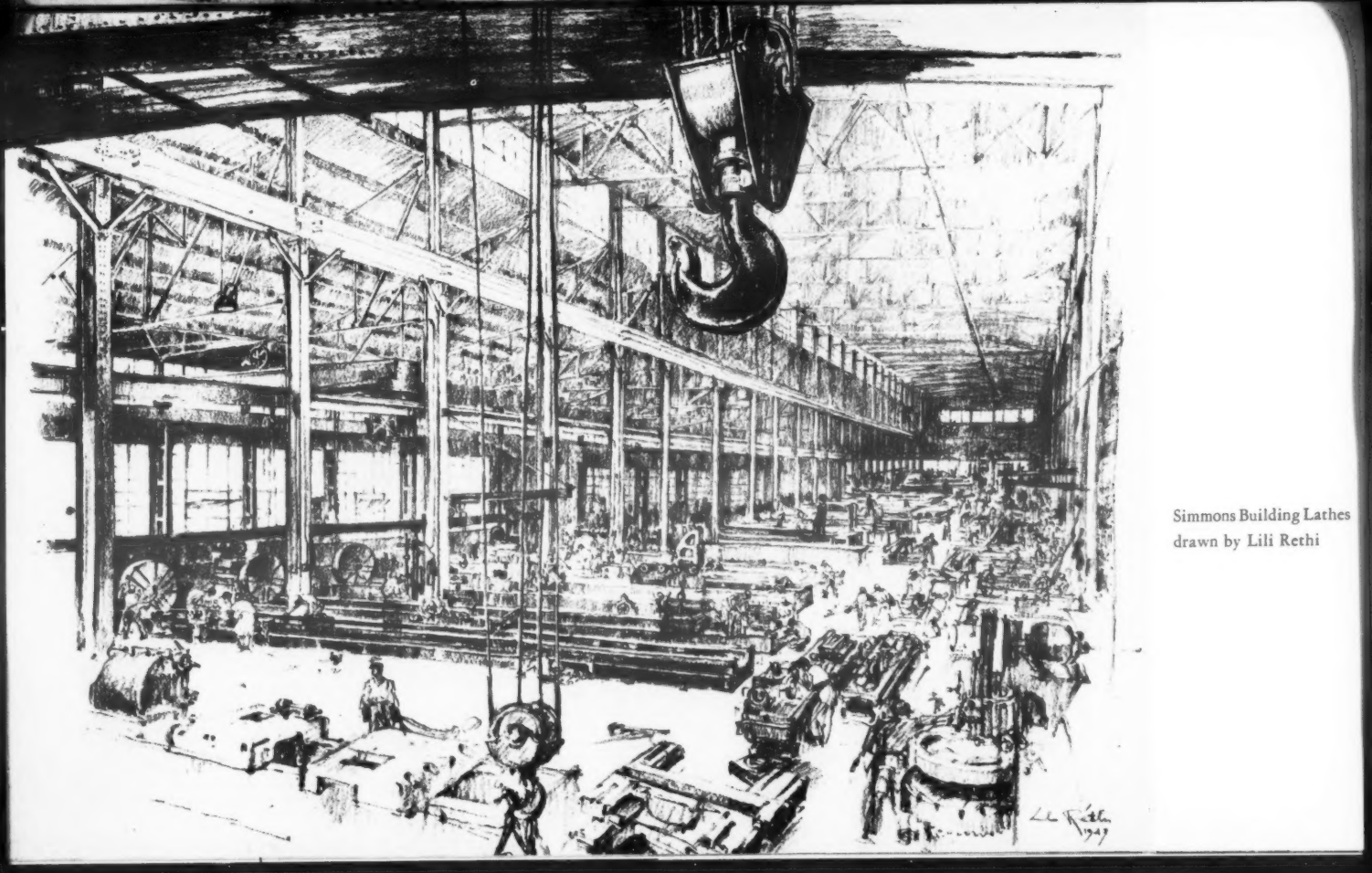
Despite the infinite amount of technical detail which she portrays in her drawings, all of which meets with the exacting approval of engineers, Miss Rethi works with almost unbelievable speed. She averaged two days per drawing during her stay at the Simmons plant.

Last year the United States Navy published a book of Miss Rethi's drawings of Naval Drydocks and at present she is engaged in making a series of drawings of the Alaska Highway.

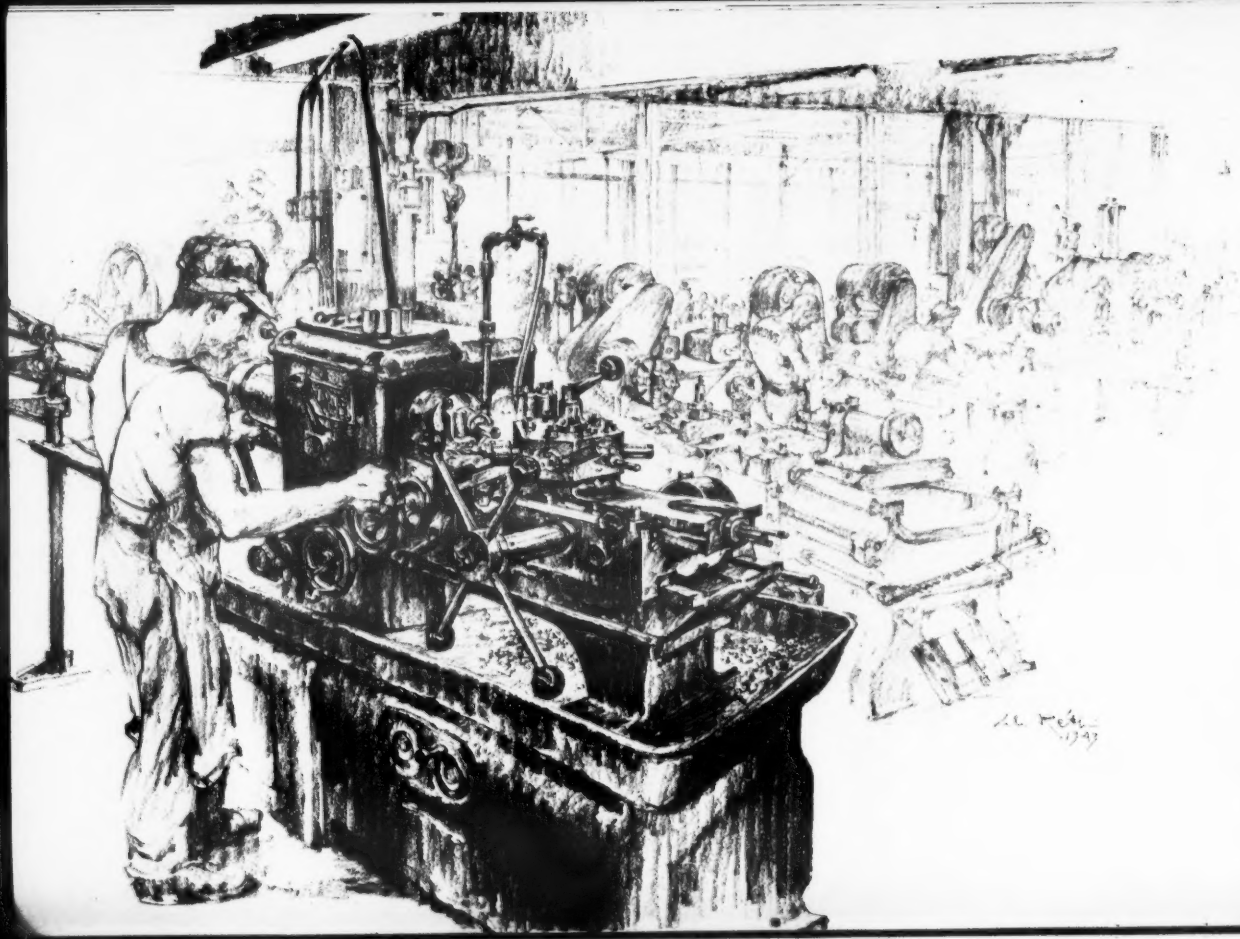
The last-minute opportunity to present these reproductions of Lili Rethi's extraordinary drawings seemed so important to us that we felt justified in rearranging our pages after the Table of Contents had been printed.



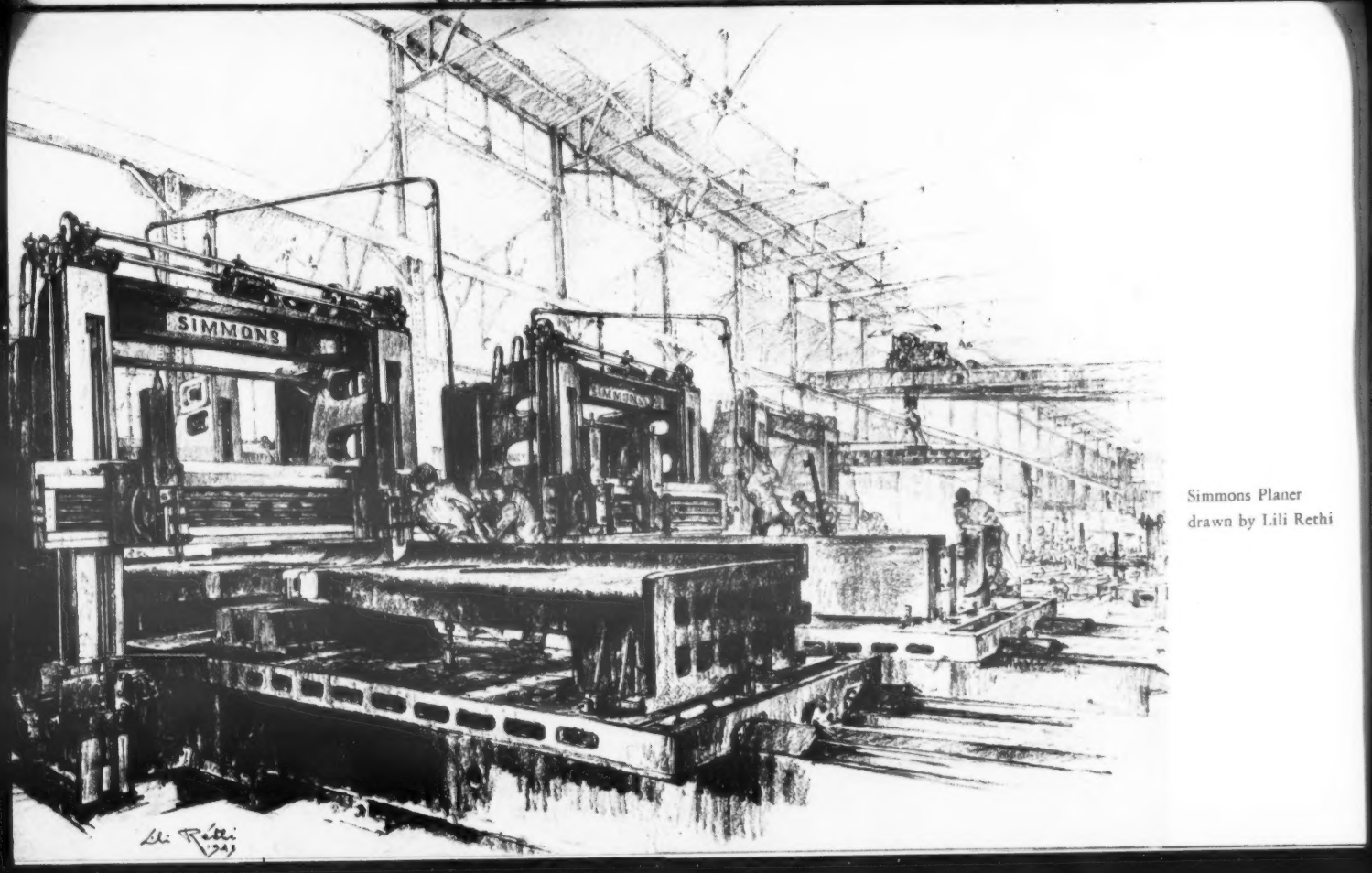
Simmons Micro-Miller
drawn by Lili Rethi



Simmons Building Lathes
drawn by Lili Rethi



Simmons Turret Lathe
drawn by Lili Rethi



Simmons Planer
drawn by Lili Rethi

PLASTIC DIES FOR FORMING, BLANKING AND PERFORATING

by David Cook
PRESIDENT
The Cook Engineering Company

BORN of wartime needs,* all-plastic dies and die sets are among the latest devclopments in America's battle to beat the shortages in metal and manpower.

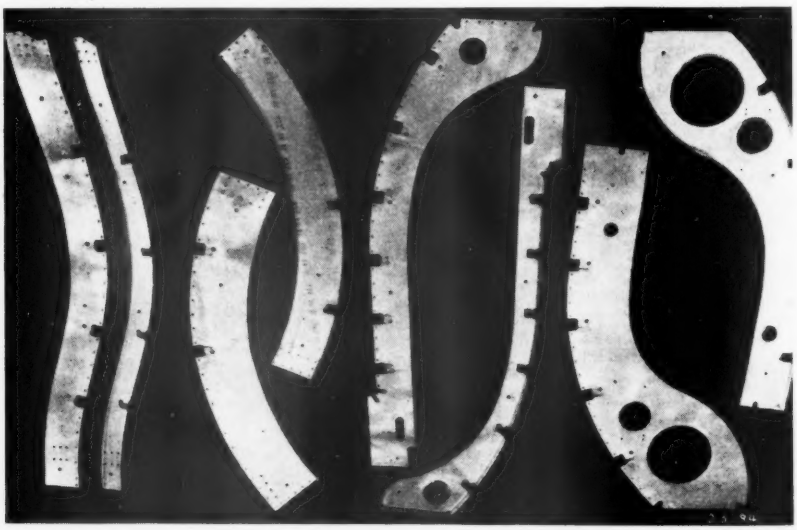
Much pioneer engineering development in all-plastic dies and die sets is credited to the Cook Engineering Company of Los Angeles and marked success has been achieved in producing such dies for piercing, blanking and forming operations.

Light and Easy to Handle

Undoubtedly the outstanding features of plastic dies are their lightness and ease of handling. When complete with

*See also: "Masonite Die Stock Speeds Production—Lowers Die Cost"—Tool & Die Journal, September, 1941. "The Utilization of Rubber in the Fabrication of Plane Stamping"—Tool & Die Journal, June 1939.

Parts shown are formed entirely without hand working. Done in one operation on a mechanical press. Provision for lightening holes, beading, punch inserts, etc., is equally successful.



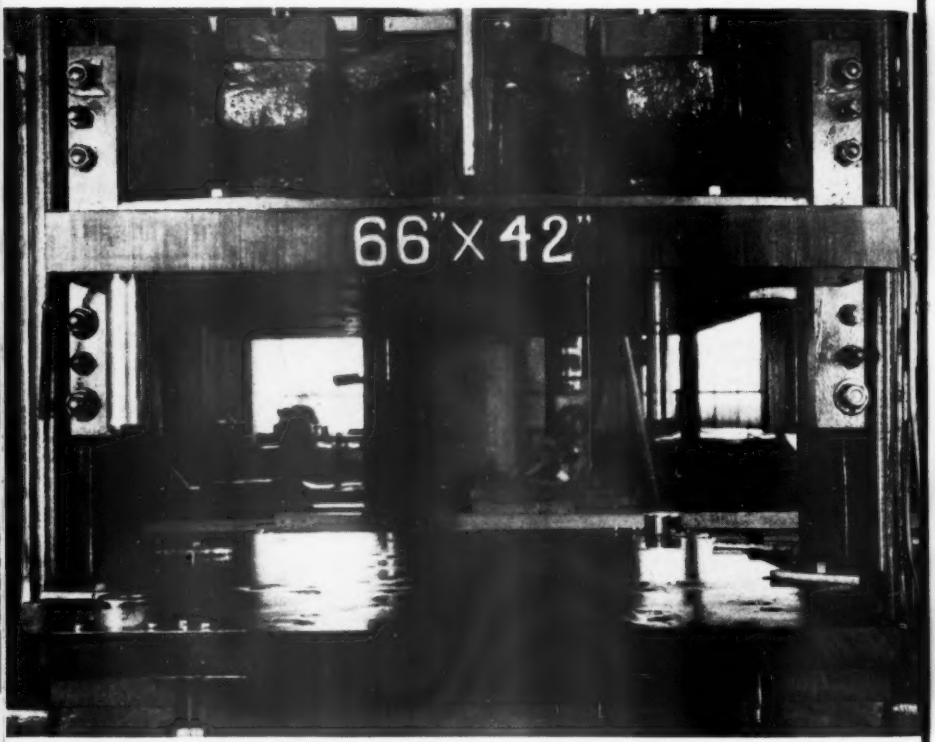
Large die easily handled by two men. Note severely shrunk flange at left hand end of die formed in single operation without hand work. 1200 lbs. of critical metal saved.

steel bolts, springs and dowel pins, the new dies are, on the average, about one-third the weight of comparable sized metal dies of equal strength and stiffness. This comparison is arrived at by considering the specific gravity of the plastic material to be approximately 1.34 as against about 7.0 for steel. This means that two men can handle a 3" plastic die-set top plate without the use of stack or crane. Thus, in addition to reducing equipment charges by eliminating crane hoisting and power trucking, materials handling is greatly simplified and expedited, and furthermore, safety engineers have pointed out that accidents are measurably reduced. With women constituting an ever increasing part of our working forces greater emphasis must be placed on light weight, safe and easy-to-handle equipment.

Plastic Dies Quickly Produced and Repaired

Another strategic advantage of plastic dies and die sets lies in the fact that they may be produced in less time than is required for the manufacture of regular steel dies thus reducing the initial costs of new dies as well as replacements. When an entire aircraft production line may be held up because of broken dies the cutting of replacement time from weeks or even months down to a few days is of major military importance.

The flexibility of the plastic die is of interest to all industry in general but particularly to the aircraft field. The



This die set weighs 690 lbs. Upper shoe 3″ thick and lower 2″ thick. Corresponds in strength and thickness to 1⅝″ steel or 1⅛″ cast iron. Equivalent steel weighs in excess of a ton. Another ton of steel and many man hours of critical planning, grinding and handling time saved.

relatively small runs of aircraft parts and the rapid design changes require frequent die revisions. Thus, on a short run, half the utility of an expensive steel die set might never be realized, whereas minor changes might readily be incorporated in an existing plastic die.

Obviously there is a major conservation of critical materials inasmuch as the dies require steel only in the bolts, dowels and springs. Expensive scrap is greatly reduced as errors may ruin only a small section of a laminated-plastic die rather than an entire steel die.

(Continued on Page 133)

This die weighs 100 lbs. Two girls can handle and set it up.

ALTHOUGH the Tool & Die Journal "production line" is not permeated with the odor of cutting oils and we are not having to battle with heat treating, drill breakage and gage wear we wish to go on record that nevertheless we, also, have manpower troubles!

Three months before Pearl Harbor our Government recognized his practical background and intimate working knowledge of the Tool and Die Industry by prevailing upon our Publisher and Editor George J. Huebner to serve first as Tool and Die Consultant and later as Chief of the Tooling Branch, Facilities Bureau, War Production Board, in Washington.

We are violating no confidences — but simply exercising editorial license by disregarding G. J. H's modest reticence — in stating that, as our armament program assumed astronomical proportions, the successfully enlisted cooperation of the country's tool and die plants to the end that threatened tooling bottlenecks were both nipped in the bud and even forestalled bears testimony to a conscientious and enviable job done in alleviating production crises by getting critical tools produced and in converting impossible delivery situations into tools on hand when and where they were so strategically needed. The men on his staff were referred to by officers in the Bureau of Ordnance of the Navy as "the men who pull rabbits out of hats."

Assistant Editor Reed, for many years an enthusiastic participant in reserve officer training classes and encampments, traded-in his civilian title in February 1942 and now we forward mail to Lt. Col. Paul L. Reed, U. S. Coast Artillery.

In January of this year former Circulation Manager and later Assistant Editor Charles H. Haynes joined the Army and is now a candidate for officer's training.

All this time the increasing burden of a rapidly growing Tool & Die Journal was on the able shoulders of Don E. Root, Assistant Publisher and Editor. Young in years but by now an old and experienced hand in the technical publishing field, he had helped "paste-up" the first "dummy" of the Tool & Die Journal. Ever since he has radiated an aura of printer's ink, tear sheets, advertising contracts, expanding circulation statistics, mailing services, editorial policies, technical writing and book publishing.

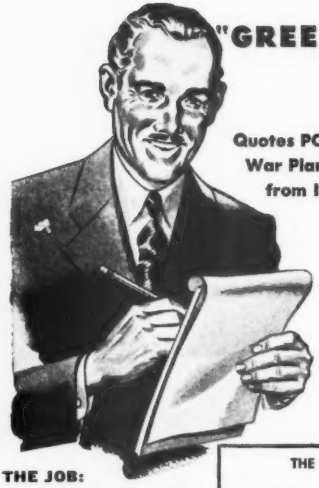
Coincident with this, our October issue, going to press, Apprentice Seaman Don E. Root disembarked at the Great Lakes Naval Training Station in Illinois.

This leaves the Tool & Die Journal with no alternative to "re-possessing" Editor Huebner from Washington. He will return on leave of absence to immediately resume active direction as Publisher and Editor. This insures uninterrupted and undiminished efforts to the end that the Tool & Die Journal shall continue to conscientiously serve its readers.

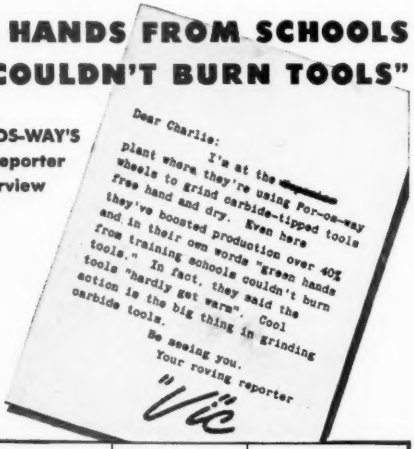
Our elation at having "G.J." back in the driver's seat is admittedly tinged with selfishness when we realize that our gain is the Government's loss.

THE TOOL & DIE JOURNAL STAFF

"GREEN HANDS FROM SCHOOLS COULDN'T BURN TOOLS"



Quotes POR-OS-WAY'S War Plant Reporter from Interview



Dear Charlie:

I'm at the [redacted] Plant where they're using Por-os-way wheels to grind carbide-tipped tools free hand and dry. Even here they've boosted production over 40% and in their own words "green hands from training schools couldn't burn tools." In fact, they said the tools "hardly get warm". Cool action is the big thing in grinding carbide tools.

Be seeing you.

Your roving reporter

"Vic"

THE JOB: Grinding free-hand and dry on Excello Tool Grinder carbide-tipped tools 1" x 1" x 6", for turning airplane struts, shaping airplane carburetors, shaping and turning gun turrets for planes.

THE WHEEL: Por-os-way 10" x 2" x 2" C54KV3.

All facts and figures given are taken from an actual field survey.

See our exhibit booth at Room 777 Palmer House, National Metal Congress, week of October 18.

THE RECORD	POR-OS-WAY WHEEL	FORMER WHEEL
Number tools per hour per man	37	26
Number of dressings required	NONE	Every 2 hours
Pieces per wheel	888	520
Stock to be removed	.000"—.250"	same
Wheel life	24 hours	20 hours
Depth of cut	.002"—.010"	Tools burned when jammed into wheel
Number of passes required	12	48
Amount of rejects	0	50 per day (scrapped)
Increase in production	42.3%	

WRITE, for complete booklet "Facts About Por-os-way". The address is 464 Wheatland Street, Phoenixville, Pa.

2 TO 5 TIMES MORE WAR PRODUCTION PER MAN PER MACHINE

POR-OS-WAY*

a new

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A. P. DE SANNO & SON, INC.
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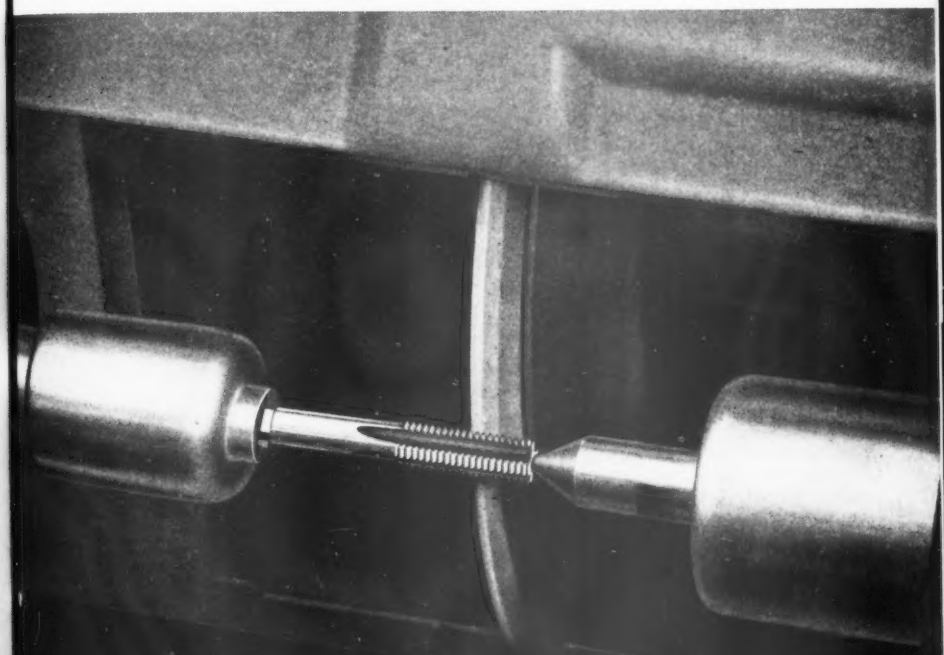
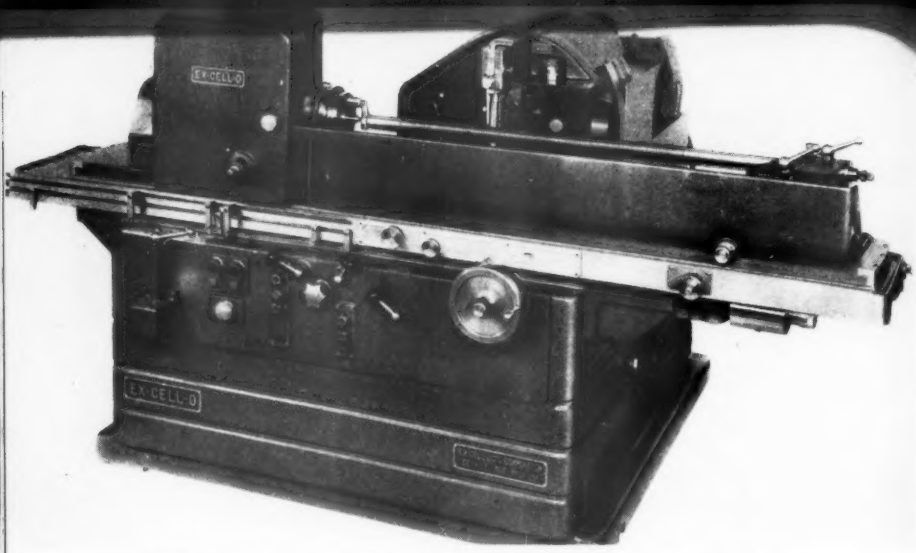
TRAINING *for Victory*

EDITORS: DON E. ROOT CHARLES H. HAYNES



THREAD GRINDING TECHNIQUE



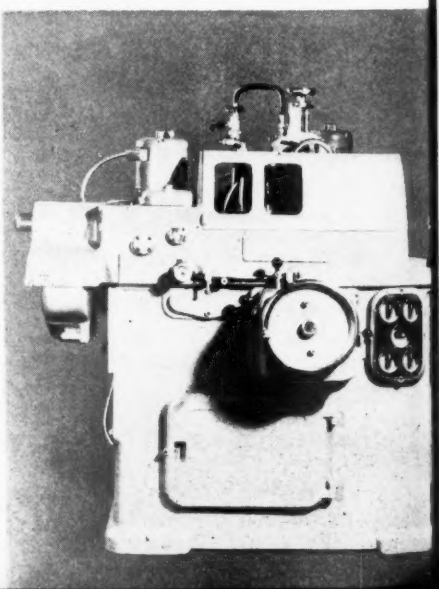
Ex-Cell-O Precision Thread Grinder set up for grinding long lead screw.

THE technique of precision thread grinding is not new because for years micrometer and instrument screws and machine tool lead screws have been ground after hardening. However, today the operation has become highly diversified and widely adopted and is being applied to precision parts for aircraft engines, instruments, gun parts and for countless other standard components.

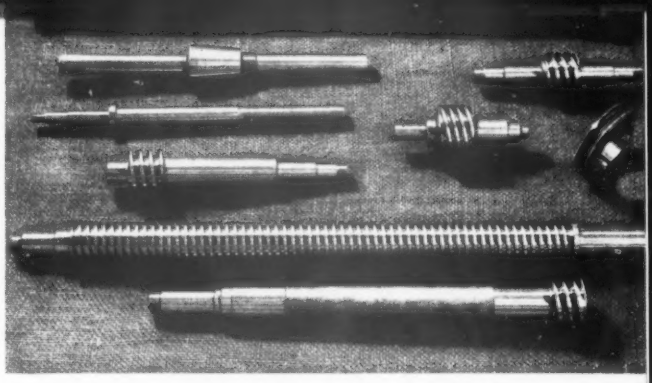
Instead of using a single point tool, chaser or thread milling hob, a grinding wheel is employed thus giving a much superior finish and a more accurate and precise thread. A grinding wheel is formed to the correct profile by special types of wheel dressing devices. In practically all cases where precision is a factor, grinding offers many advantages over the conventional thread machining methods. It is a common practice to rough cut the thread before heat treating, leaving from .010″ to .015″ on the diameter for removal by the finish grind after hardening. Grinding after hardening assures that the thread is held accurately concentric with other ground diameters and with other threaded sections on the work part. Thread grinding is particularly advantageous where fine threads are required on hardened pieces. Such threads are ground into the piece after hardening. This eliminates the possibility of distortion or surface decarburization during heat treatment.

There are two types of thread grinding operations. Some machines are built on the principle: slow work speed with large cutting depth, the object being to

Sheffield Precision Thread Grinder.



perform the grinding passes. Grinding does not take place on the return stroke. The second grinding principle is: high work speed with small cutting depth. These machines are built to grind in both directions and are designed to eliminate the errors of backlash. In addition to special thread grinding machines, thread grinding attachments are available for use on lathes and the following information on thread grinding technique should be of equal value whatever the type of equipment employed.



Typical Thread Grinding Work.

Most thread grinding machines are built on the same basic principle and as with all other machine tools the actual cutting tool and its maintenance are most important factors in attaining satisfactory performance.

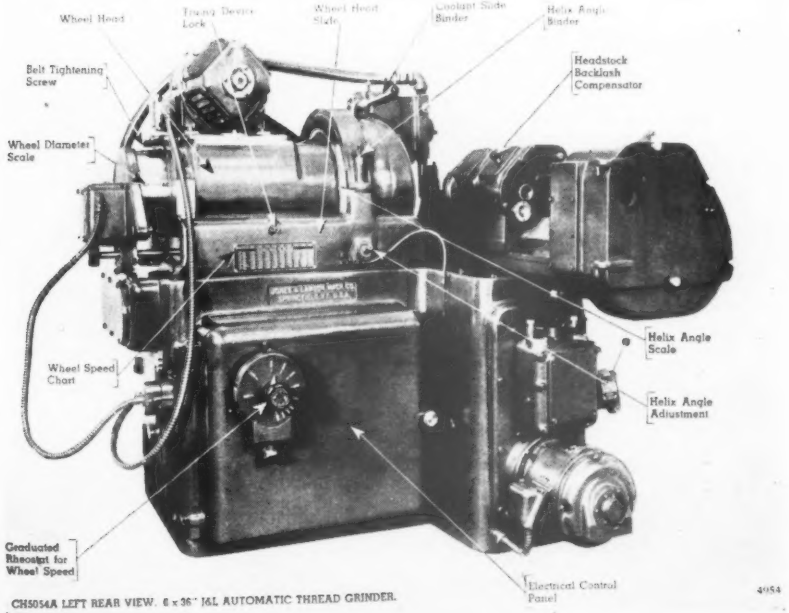
The Grinding Wheel

The grinding wheel is formed or dressed to conform to the desired thread profile by a wheel truing process. This operation is particularly important.

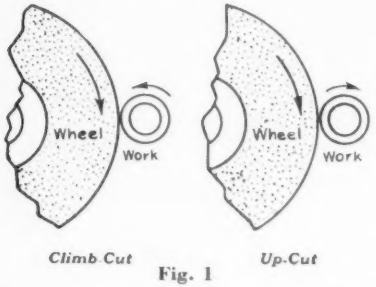
As in all other grinding operations the type and grade of wheel for thread grinding must be chosen in accordance with the grinding speed, work feed and material being ground.

Inasmuch as the grinding of threads is accomplished by imparting to the work-piece the desired thread profile by means of the grinding wheel, the grinding wheel must first be accurately shaped to the thread profile and then that wheel

Jones & Lamson 6″ x 36″ Automatic Thread Grinder. Left rear view.



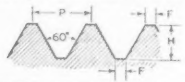
CH5054A LEFT REAR VIEW. 6 x 36" J&L AUTOMATIC THREAD GRINDER. 4954



Climb Cut *Up-Cut*

Fig. 1

AMERICAN STANDARD THREAD FORM



Number of Threads per Inch (Commonly called Pitch)	*Pitch or Lead P*	*Depth of Thread H*	*Width of Flat F (Commonly called Root)*
80	.0125	.0081	.0016
72	.0139	.0090	.0017
64	.0156	.0101	.0019
56	.0178	.0116	.0022
48	.0208	.0155	.0026
44	.0227	.0147	.0028
40	.0250	.0162	.0031
36	.0278	.0180	.0034
32	.0312	.0203	.0039
28	.0357	.0232	.0045
24	.0416	.0270	.0052
20	.0500	.0325	.0062
18	.0555	.0361	.0069
16	.0625	.0406	.0078
14	.0714	.0464	.0089
13	.0769	.0499	.0096
12	.0833	.0541	.0104
11	.0909	.0590	.0113
10	.1000	.0649	.0125
9	.1111	.0721	.0139
8	.1250	.0811	.0156
7	.1428	.0928	.0178
6	.1666	.1082	.0208
5	.2000	.1299	.0250
4½	.2222	.1443	.0278
4	.2500	.1624	.0312

Pitch P = 1 ÷ number of threads per inch.
Basic Depth H = 0.6495 x Pitch.
Basic Flat F = 0.125 x Pitch.

Fig. 2

shape must be maintained during the grinding operation to insure uniformity of output.

Relationship of Grit Size to Root Width

Root Width	*Grit Size (Norton Scale)*	
	Vitrified Wheels	*Resinoid Wheels*
.003"	#220	#180
.004"	180	150
.005"	150	120
.006"	120	120
.007"	120	100
.008"	100	100
.009"	100	90
.010"	90	90

Where necessary to maintain a root of definite width, wheels coarser than indicated in this chart are not recommended.

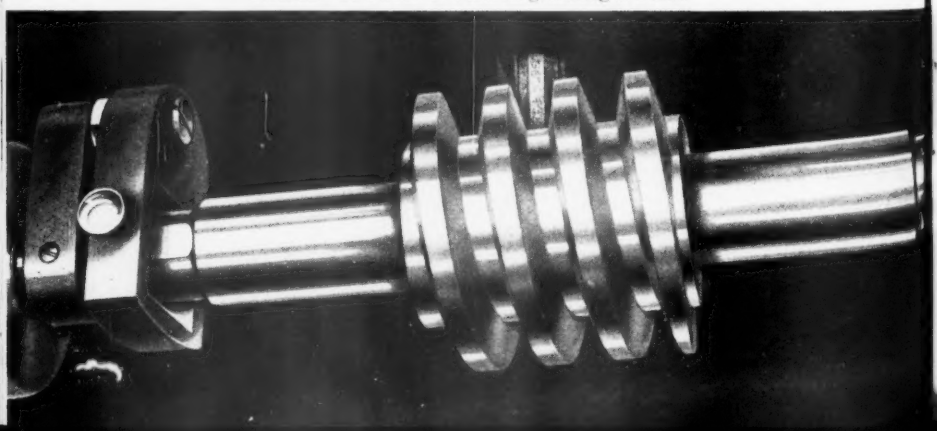
Fig. 3

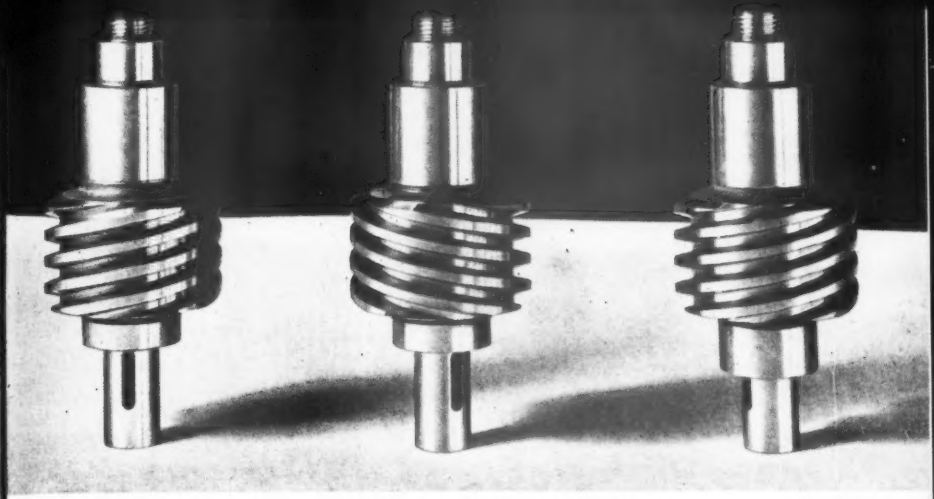
The forming or dressing of the wheel is done by diamond or hardened steel dressers which may be either hand or automatically operated, the latter in the case of high production, long run jobs so that "untruth" of the wheel shape due to wear may be kept well within the tolerance established for the finished product.

When threads are ground by a single-ribbed wheel the wheel is dressed by a diamond and the motion of the diamond is mechanically guided to insure accuracy of thread profile. In the case of multi-ribbed wheels the wheel shape is attained by the "crushing" action of hardened steel rolls against the wheel. For thread profiles involving rounded crests and roots the single point dresser may be controlled by a device such as is used in wheel dressing for grinding formed tools or its dressing travel about the face of the wheel may be governed by a pantograph arrangement.

Inasmuch as the technique of thread grinding is comparatively new and is being expanded so rapidly that new grinding operators are being trained constantly, it may be well to discuss a few of the usual problems that confront

Relation of wheel to work in grinding a worm





Not only the worm but also the V-threads of three hardened work-pieces are ground.

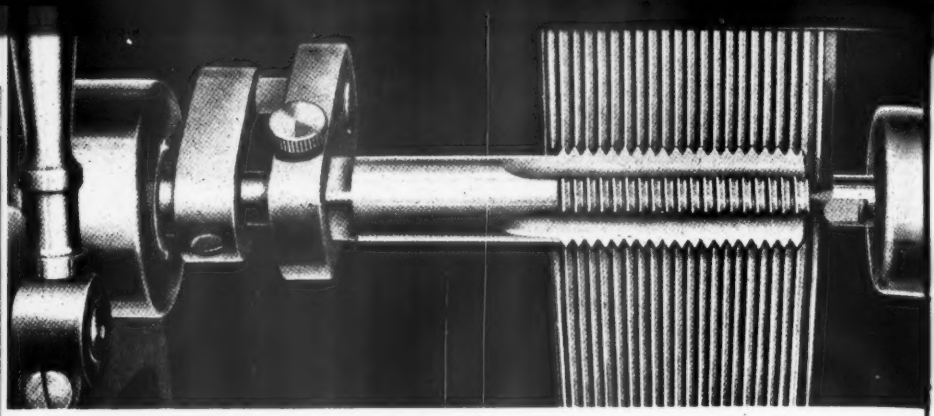
the new worker. We are confident that the suggested answers will improve the thread grinding technique on any machine.

Burning

Excessive heat or burning as indicated by discoloration of the work is probably the most common trouble encountered. The principal causes are the following:

1. Inadequate flow of coolant or improper adjustment of outlet nozzles. Make sure valve is open full and adjustment outlets so that oil will strike work where it will do the most good. Slight changes sometimes make a big difference in results.
2. Too heavy feed or too fast work speed. Heat usually increases with amount of stock removed per unit of time. There is a limit to the rate at which stock can be removed even under the best conditions. This varies with class of material. Possibly you are trying to work too close to the border line. Try a slightly slower work speed or a somewhat lighter feed. Here, too, a slight change might be all that is necessary to overcome the trouble.
3. Too slow work speed. On hardened steel burning is sometimes eliminated by increasing the work speed and reducing feed in proportion.
4. Wheel speed. Where a relatively fine wheel is being used to maintain a narrow root and where the pitch is relatively coarse so that a large amount of material must be removed, a higher wheel speed often reduces the tendency to burn. In other cases, reducing the wheel speed will reduce burning, but this is apt to cause the edge to wear more rapidly.
5. Direction of work rotation. More heat is usually generated by the "climb-cut" than the "up-cut" direction (Fig. 1). Try to re-arrange cycle so that finishing cut will be made on the "up-cut". Try reducing amount of feed a little on the climb-cut and add it to the up-cut.

View through microscope of thread and wheel profile.



Tap grinding with multi-ribbed wheel.

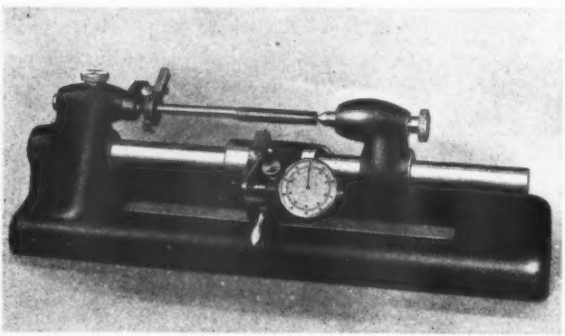
Root Width

The chart (Fig. 2) shows the allowable root widths for U. S. Standard Thread Forms of various pitches. On many classes of work it is customary to maintain narrower widths than this. Maintenance of root width, therefore, often presents a real problem. The following factors should be studied if trouble is being encountered:

1. Grit size. It is not practical to maintain a very sharp edge on a wheel if it is too coarse. The table (Fig. 3) shows the coarsest grits which are recommended for producing root form of various widths.

   On moderately coarse pitches (12 to 18) a coarser wheel will often hold the desired form better than one which is too fine.
2. Bond. As a general rule resinoid wheels maintain a better edge than do vitrified wheels. If the work does not call for extreme accuracy of lead, a resinoid wheel is recommended to hold a fine edge.
3. Wheel speed. An increase in wheel speed often helps to maintain narrow root width.
4. Coolant. Inadequate flow or improper application of oil is frequently responsible for rapid breakdown of edge especially where a resinoid wheel is being used.
5. Distribution of feed. If too heavy a roughing cut is taken, hoping this will leave a minimum of work for the finishing cut, the point of wheel is apt to break down in the roughing cut leaving an excessive amount of material for the point to do on the finishing cut. On 12 pitch U. S. Standard screws a feed of .036″ for the roughing cut and .018″ for the finish is usually satisfactory. Some experimenting may be required to find the best combination for other pitches.

Pitch setting device.



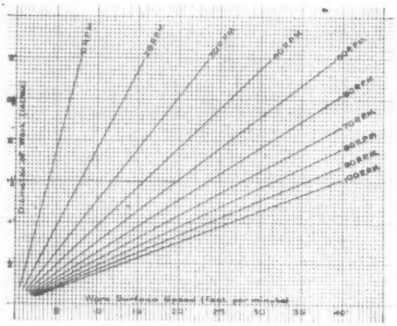
Thread Form

Poor thread form is usually attributable to improper truing. If the diamond is badly worn or loose in the shank, it is impossible to true a correct form on the wheel.

Do not try to take too heavy cuts when truing a resinoid wheel. The diamond, if dull, might cause enough deflection of the wheel to affect the form.

Lead Error

This occasionally occurs when using resinoid wheels, especially if the thread is pre-cut and distorted in hardening. Also on large diameter work there is apt to be some slight springing of a resinoid wheel near the end of the thread where the edge of wheel is not fully supported on both sides. Where lead error is being experienced which cannot be tolerated, a change to vitrified wheels is recommended.



Graph No. 1—Peripheral Speed in Feet per Minute to Revolutions per Minute

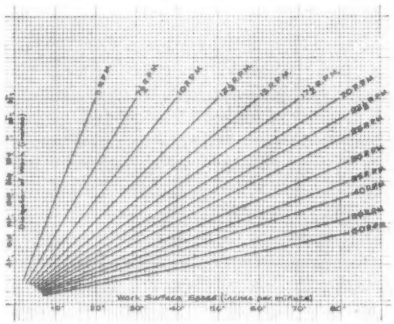
Poor Finish and Chatter

Some of the more common causes are the following:

1. Diamond lines can be distinguished from abrasive scratches because they are very evenly spaced. If objectionable, they can be eliminated or reduced by using slower diamond feed or lighter feed when truing the wheel, especially on the final passes.
2. Surface roughness is often caused by too heavy cut or too high work speed on finishing pass.
3. Chatter can be due to several causes. If wheel is out of balance, true it as carefully as possible; remove it from machine and balance it; then re-true lightly.

An attempt to true too sharp an edge on a relatively coarse wheel usually results in a ragged edge which sometimes causes chatter in the root. Try truing a slight flat on the edge.

Too high work speed, or any combination of conditions whereby wheel is taxed beyond its stock removing capacity is apt to cause chatter.

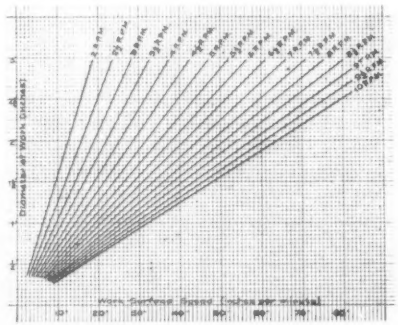


Graph No. 2—Peripheral Speed in Inches per Minute to Revolutions per Minute

General Suggestions

Mounting, truing and balancing. Be sure faces of flanges and sides of wheels are clean and free from any foreign material. Thin gaskets such as are provided by the machine maker or blotters supplied by the wheel maker should be used. Do not use both at once.

Tighten flanges evenly and not too



Graph No. 3—Peripheral Speed in Inches per Minute to Revolutions per Minute

tight. If wheel sleeve is of the removable type, balance the whole unit carefully. It usually saves time when balancing a new wheel to first remove the balancing weights entirely and start "from scratch." The wheel should be carefully trued before balancing to make sure that it runs true on the wheel sleeve, otherwise the balancing will not do much good.

True wheel carefully and do not use too heavy diamond feed. This applies to truing before as well as after balancing.

Wheel speed. Wheel speed on thread grinding varies from 7500 to 12,000 surface feet per minute. Most thread grinding wheels are strong enough to safely stand even 12,000 sfpm but some of the coarser ones may not be. The wheel maker shows the maximum operating speed on each wheel. Do not exceed this limit.

The most common speeds are between 8000 and 10,000 sfpm. On high production commercial work speeds up to 12,000 sfpm are generally used. Slower speeds are sometimes used for finish grinding.

The most important thing to remember once the best speed for a given job is established is to *maintain* a reasonably constant surface speed by increasing the rpm as the wheel wears down.

Work speed. It is not practical to list the best work speeds for all classes of work. Perhaps a good place to start would be with a work speed of about 2½ feet per minute on work of medium pitch where it is desired to finish from the solid in two or three passes. Some people prefer much higher work speed with very light feed on hardened high speed steel. Others prefer fewer passes with heavy feed which naturally calls for slower work speed.

Once a satisfactory work surface speed has been found for a certain pitch and kind of material, the same surface speed will also be satisfactory on other diameters within a reasonable range.

Graphs Nos. 1, 2 and 3 will be helpful n determining the revolutions per minute at which work of various diameters should be run in order to obtain any desired work speed.

Select the graph that covers the desired conditions. (Note that work surface speed on Graph No. 1 is in FEET per minute. On the others it is in INCHES per minute.) Find diameter of work-piece in left vertical margin. Follow corresponding horizontal line to where it intersects the diagonal line representing rpm of work. From point of intersection trace vertical line to bottom of chart and find resultant work surface speed in feet per minute or inches per minute as case may be.

Coolant. Keep the grinding oil clean. Remove the settlings frequently. Good work cannot be produced with dirty oil.

Keep outlets properly adjusted. It is usually necessary to readjust them with every change in work size. A slight adjustment will often eliminate burning and also reduce objectionable splash.

A little time spent in making a simple splash guard for a special job will often permit the full flow of oil without trouble, thus permitting maximum rate of stock removal.

Do not shut oil off entirely when truing or dressing. A little oil will reduce diamond wear and reduce danger of cracking.

We are indebted to Federal Products Corp., Bartelt Mfg. Co., Geo. Scherr Co., Sheffield Corp., and others for illustration and textual data for this special section.

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TOOL & DIE JOURNAL - 2460 FAIRMOUNT BLVD. - CLEVELAND 6, OHIO

TOOL AND DIE INDUSTRY FORMS NATIONAL ASSOCIATION

FORTY owners and executives representing Contract Tool and Die Shop groups in ten important industrial areas met at the Palmer House in Chicago on September 28 and 29 to organize the National Tool and Die Manufacturers Association.

Members of this industry which has had the responsibility for designing and building such a large percentage of the special tooling required for war production have long realized the need for a strong national organization which would assist local groups and their associations to coordinate their efforts and to provide in Washington the representation to which the Industry's importance and its volume of business entitle it.

Credit for launching the effort at organization was given to three heads of representative Cleveland Tool and Die plants who at their own expense sent a representative to survey the field and interview Industry members from St. Louis to Minneapolis and Chicago to New England. Most of the Industry groups who met with M. W. Rowell indicated their interest in a national association so convincingly that E. B. Bunell, F. C. McKinney and L. A. Sommer considered themselves obligated to assist in what had so quickly become an Industry organization movement.

Under direction of legal counsel Articles of Association and By-Laws were adopted, directors and officers were elected and a general manager employed. The objects of the new association as stated in its Articles of Association are:

> "The purpose of this Association is to promote, by any lawful means, the general development and improvement of the Tool and Die Industry; and, in doing so, to originate, promote or take part in any lawful movement or enterprise which, in the judgment of the Board of Directors of the Association, will

★

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tend to preserve and promote the best interests of the United States of America, the American System of Industry and of the persons, firms and corporations directly and indirectly interested therein."

Membership in the Association is available to:

"Any individual (being an American citizen), firm, corporation, or business entity in any form, regularly engaged in the business of manufacturing for sale special tools, dies, jigs, fixtures, molds, gages or special purpose machinery, . . ."

A uniform membership fee was decided upon but annual dues are proportional to the number of employees, thus making it possible for even smaller plants to derive the full benefits of Association membership at a moderate cost.

M. W. Rowell, formerly an executive of the Chain Belt Company of Milwaukee and The Sommer and Adams Company of Cleveland, has been retained as General Manager. His office and the headquarters of the Association are to be in Washington, D.C. Mr. Rowell brings to the Association much valuable experience throughout industry and among Government agencies.

Among the early objectives for which the Association will strive on behalf of the Tool and Die Industry are:

A continuance of the cooperation with production industries which has characterized the efforts of tool and die manufacturers since Pearl Harbor and before. Recognition of the Industry's accomplishments which have been so essential to successful prosecution of the War will be publicized and at the proper time the Industry's facilities will be made available for an orderly transition to peace-time production.

Manpower—the retention of the Industry's highly-skilled workers has been a vital problem. Inasmuch as it will continue to be, one of the major early efforts will be directed to bring about a comprehensive understanding of the need for the retaining of tool, die and gage makers if tooling for production is to be maintained.

Renegotiation of the Industry's war products' tooling contracts will be given consideration in an effort to establish it on an equitable basis and with due consideration for the accomplishments of Industry members.

It has long been known that the Industry's annual output compares favorably with those of other industries but it is not generally realized that the Industry produces tooling the value of which is now estimated to be more than three-quarter billion dollars. One of the early activities therefore will be a comprehensive survey of the Industry's facilities and output.

Legislation, labor relations and post war problems will be studied by Industry committees and as stated in the Articles of Association the Industry expects to take its place with other industries in every effort that will preserve the American system of Free Enterprise for both capital and labor.

The National Tool and Die Manufacturers Association has requested the Tool and Die Journal to announce that charter membership lists will remain open until December 1, 1943. For application form and other information address:

M. W. Rowell, General Manager
National Tool & Die Manufacturers Association
c/o The Willard Hotel
Washington, D. C.

JOMINY END-QUENCH HARDENABILITY TEST PREDICTS STEEL PERFORMANCE

Greswold Van Dyke

MANAGER

Special Steel Department

Joseph T. Ryerson & Son, Inc.

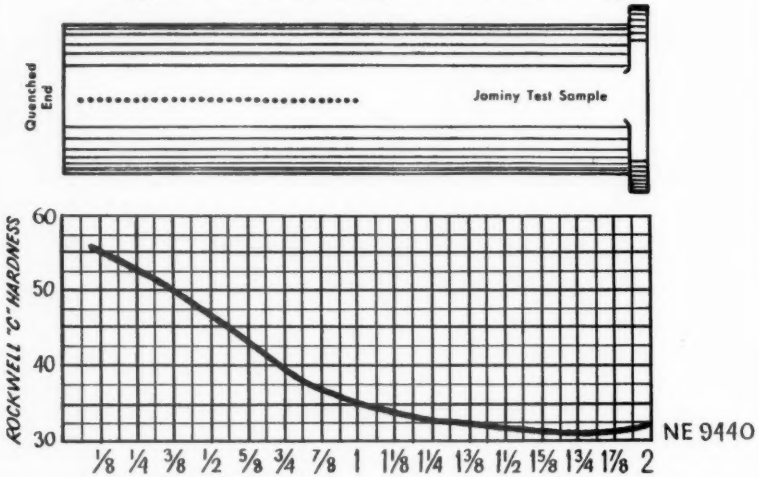
STEEL producers have constantly improved their manufacturing methods to meet the user demand for alloy steels of ever narrowing chemical analysis ranges but to produce composition ranges narrower than those in use today would be undoubtedly of questionable economic justifications.

Steel behavior in relation to machinability, its response to heat treatment, and other required physical characteristics is governed mainly by its analysis and therefore the specifying of close analysis control has as its objective the procurement of steel which will be uniform in performance.

War time scarcity of alloying elements has necessitated the development of the new low alloy content National Emergency (N.E.) Steels. Insufficient time to

Jominy Hardenability Test Sample being quenched. Note that the quenching fixture is close to the furnace to prevent heat loss during transfer of the sample.

Diagram of Jominy Sample—Actual Size—Fig. 1



This diagram and chart show how Rockwell "C" readings are taken along the ground surface of a Jominy sample. These readings taken at regular 1/16" intervals indicate the degree to which the steel hardens at various cooling rates. These readings can further be interpreted in terms of hardness obtainable on the surface, half radius or center of various size bars of the same steel. Hardenability is the key to all other physical properties as demonstrated in the following tables.

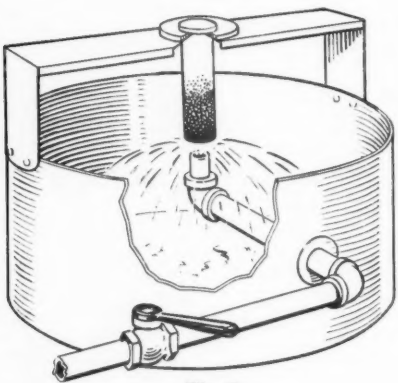


Fig. 2

Diagram of a Jominy Test in action

For readers desiring to construct the Jominy Test Fixture we will be glad to procure a detailed blue print. Ed.

check these steels by commercial use called for a method of evaluating their performance by a quickly and accurately made test. Inasmuch as most alloy steels undergo some form of heat treatment before use the problem of determining their ability to respond to heat treatment or their "hardenability" can be solved by the Jominy End-Quench Hardenability Test. This method of specification of steel is making considerable headway and probably will be an important factor in the future selection and purchase of steels. Prior to the advent of the Jominy End-Quench Hardenability method hardenability tests took considerable time and were expensive and most manufacturing plants lacked the necessary equipment to conduct them properly.

The Jominy Test is simple, easy to conduct and remarkably accurate in its

results. A sample of the steel being tested is normalized and then machined to size: 1" diameter for a length of 3⅞" with a ⅛" flange 1¼" diameter, Fig. 1. This sample is heated to the steel's proper quenching temperature and immediately inserted in the test fixture, Fig. 2. The water is turned on and allowed to flow against the lower end of the specimen for at least ten minutes. A flat surface .015" deep is then ground lengthwise on the quenched sample.

The result of this quenching method is that the sample is cooled very rapidly at one end and very slowly at the other. In between these two extremes all practical rates of quenching have prevailed within the sample. The rate of quenching is the major factor governing the physical properties secured from heat

Table A— Cooling Rate of Round Bars

Rate of cooling in degrees Fahrenheit per second for the surface, ½ radius and center of 1", 2", 3", and 4" rounds—both water and oil quenched.

Quench Media	1" Rd.	2" Rd.	3" Rd.	4" Rd.	Position
Water	850° F.	550° F.	400° F.	100° F.	Surface
Oil	120° F.	58° F.	30° F.	15° F.	
Water	135° F.	46° F.	27° F.	14° F.	½ Radius
Oil	53° F	24° F.	12° F.	6½° F.	
Water	100° F.	32° F.	15° F.	8° F.	Center
Oil	45° F.	18° F.	9° F.	5½° F.	

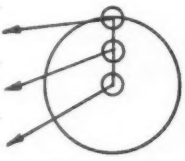


Table B— Cooling Rate in Jominy Test

Rate of cooling in degrees Fahrenheit per second at the distance indicated from the water cooled end of a standard Jominy end-quenched specimen. The Jominy Test uses a water quench because water is a constant quench media which produces all oil and water cooling rates.

1/16—600° F.	¼—72° F.	7/16—37° F.	⅝—22° F.	1 —10° F.	1½—5.5° F.
⅛—190° F.	5/16—56° F.	½—30° F.	¾—18° F.	1⅛—8.5° F.	2 —4.3° F.
3/16— 99° F.	⅜—44° F.	9/16—26° F.	⅞—14° F.	1¼—7.2° F.	

Table C—Approximate Physical Properties in Relation to Hardness

These figures are based entirely on hardness and show only probable physical properties usually associated with hardness. These figures are reasonably accurate for properly quenched steels but will be misleading if interpreted to apply to steels of lower than 15 or higher than 42 Rockwell C hardness. This table is apt to be more accurate for alloy steels of .30 carbon or higher. Low carbon steels produce yield points less than those indicated.

Rockwell C Hardness	Brinell Hardness	Tensile Strength P.S.I.	Yield Point P.S.I.	% Elong. in 2"	% Red. of Area
15	200	95,000/105,000	70,000/ 80,000	22/28	60/68
20	225	106,000/119,000	87,000/100,000	21/26	57/65
24	250	118,000/132,000	102,000/112,000	20/25	55/63
28	275	130,000/145,000	115,000/125,000	18/23	52/61
31	300	142,000/158,000	127,000/135,000	17/21	50/58
34	325	153,000/172,000	137,000/146,000	16/20	47/56
37	350	165,000/185,000	150,000/159,000	14/18	45/54
39	375	176,000/200,000	163,000/172,000	13/16	42/51
42	400	187,000/221,000	175,000/184,000	11/15	40/49

treatment so by taking Rockwell "C" readings at 1/16" intervals along the length of the quenched Jominy sample it is possible to determine how the steel behaves at different quenching rates ranging from about 600° per second at the quenched end to 40° per second at the other end.

In order to pass on to users the advantages of hardenability information, Joseph T. Ryerson and Son, Inc., is now conducting Jominy Hardenability Tests on each heat of alloy steel as it comes from the producing mill from which charts are prepared that accompany all shipments of alloy steel from each particular heat. This system furnishes the customer a quick, accurate picture of the heat treatment response which can be secured from the alloy steel received. It is believed that this information will effect a considerable saving of time and experiment in the user's plant.

Obviously, the standard Jominy Test as just described indicates the hardenability of the steel only in the "as quenched" condition. Most alloy steel is used after having been quenched and drawn hence Ryerson has devised a modification of and a means for interpreting the Jominy Test for steel which has been quenched and then drawn at 1000° F, 1100° F, and 1200° F. This information is incorporated on the charts accompanying each shipment and is expressed in terms of obtainable physical properties for bars 1" Rd., 2" Rd., 3" Rd. and 4" Rd. at the three draw temperatures indicated.

The Ryerson modified Jominy Test and procedure in using it to determine an alloy steel's physical properties is illustrated by the following step-by-step example:

Suppose that it is required to find the physical properties existing at the center of a 2" round bar, to be oil quenched and then drawn at 1000° F.

From a piece of the steel prepare a standard Jominy sample. Harden it in the Jominy fixture and draw it at 1000° F. Grind the .015" deep flat surface lengthwise of the sample and record the Rockwell "C" readings at 1/16" intervals.

Consult Table A and note that the center of our 2" round stock, quenched in oil, has a cooling rate of 18° F per second.

Looking to Table B for a Jominy specimen cooling rate most nearly corresponding to 18° F per second we find a cooling rate of 18° F per second prevailing 3/4" from the water cooled end.

Then from the record of the Rockwell readings taken on the Jominy specimen note the reading at the 3/4" location. Assume that the reading at this point was 34 Rockwell "C".

Table C gives the relationship between Rockwell Hardness and the other physical properties. Hence for our assumed Rockwell "C" reading of 34, the other physical properties at the center of a 2" round bar, oil quenched, are shown to be: Brinell Hardness 325; Tensile Strength P.S.I. 153,000 to 172,000; Yield Point P.S.I. 137,000 to 146,000; Elongation in 2" 16% to 20%; and Reduction of Area 47% to 56%.

The cooling rates at different locations in various sized bars as listed in Table A frequently do not correspond exactly with the Jominy cooling rates furnished in Table B. Judgment must be used in such instances in selecting values in between those listed and this applies also to interpretations for intermediate size bars.

If a quick hardenability test could be made on a heat of steel before tapping then by furnace or ladle additions the steel could be brought to the proper hardenability range and the inconvenience and expense of "off heats" would be materially reduced.

This idea may be reaching rather far into the future but sufficient work has been done to indicate that very interesting results can be secured from a cast sample by the Jominy method and that the results so obtained correspond very closely to those secured from finished bars of the same heat.

The time element required for making the Jominy Hardenability Test on a cast sample and the rate of loss of oxidizable hardening elements, such as chrome and manganese, would have to be closely coordinated, hence the method would introduce some very interesting problems in furnace operation and control. However, there seems to be a general thought among producers and users of alloy steel that if such a scheme could be worked out it would be worth considerable time and effort to both the steel producer and to the user.

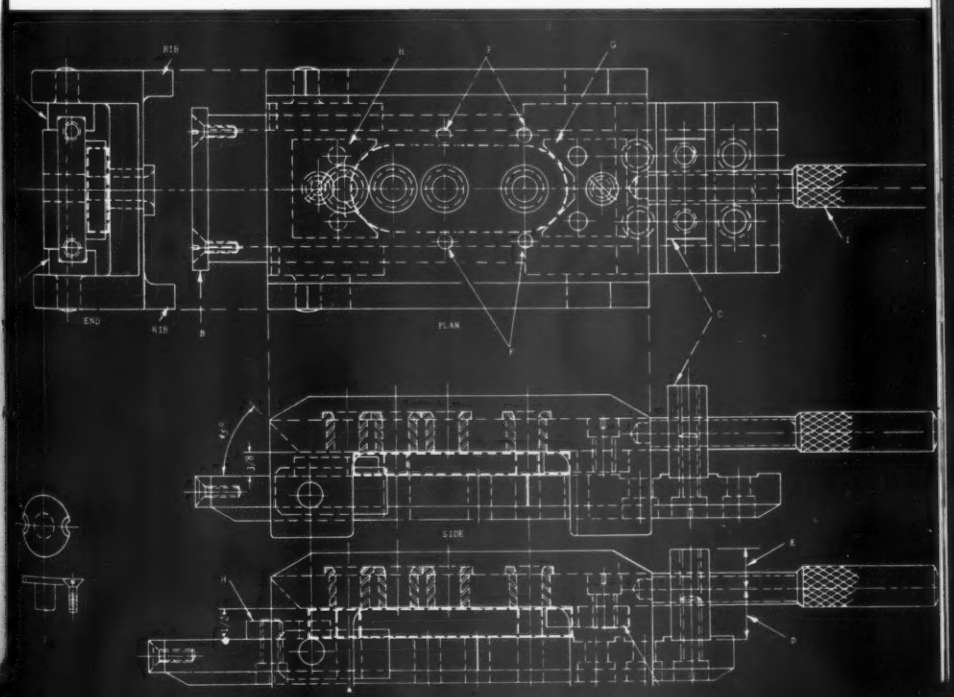
MODERN DESIGNS FOR DRILLING JIGS AND TAPPING FIXTURES

C. W. Hinman
Designing Engineer

ADJUSTABLE DRILLING JIGS

THE jig illustrated in Fig. 118 was originally designed for drilling the end holes in flat steel chain links of three different lengths and two thicknesses. The adjustable features derive from the two slotted trunnions *A* in which the thickness of the leaf is a sliding fit. Each trunnion has a round bearing boss which is an integral part of the piece and provides the hinging for the leaf. The bearing boss is a working fit in the hinge holes at the rear end of the jig and for a high output jig the bosses would be fitted in hardened and ground wear bushings. These bosses are turned on a lathe and are offset $\frac{1}{16}$" from the longitudinal center line of the slots. Therefore the trunnions will position the leaf $\frac{1}{8}$" higher or lower, depending upon the position in which they are assembled within the

Fig. 118—Semi universal jig that permits adjustments for drilling several different lengths and thicknesses of flat steel chain links.



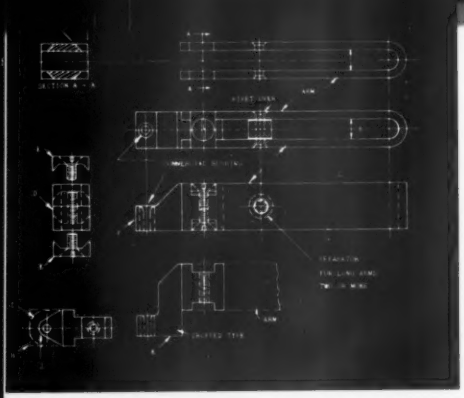


Fig. 119—An inexpensive adjustable arm with bushing holder for positioning or changing drill bushings quickly, as indicated in the tooling setup in Fig. 120.

jig. Both positions of these trunnions are shown in the upper and lower side views of the jig body. This adjustment takes care of the ⅜" and ½" thicknesses of work and is easily made by simply taking off the stop bar *B*, sliding out the leaf, and then re-positioning the trunnions.

Block *C* can be mounted on either of its ends and in any one of the shallow slots across the leaf. Because the tapped hole in the block for clamping screw *I* must be at a height that will correspond to either position of the trunnions and leaf, dimension *D* is made ⅛" greater than *E*. This feature maintains parallelism between the floors of the leaf and jig body.

To load this tool it is rested on its ribs and the work is placed between the four approximate locating pins *F* and within the V-jaws of block *G*. Block *G* is positively attached on the floor of the jig channel. The leaf, which also carries a positively attached and aligned V-jaw block *H*, is then closed, pulled against the work and tightened by clamp screw *I*. This action centralizes the length of the work over the bushings and also clamps the work firmly for drilling. At *J* is a plug, two of which are required. The plugs are inserted in the idle drill bushings and fastened by two flat head screws. This prevents entering the drills in the wrong bushings. It is good practice to provide convenient places on the jig for securing accessory pieces to prevent losing them when they are not in use.

This is a useful jig in the small shop where they may have no bandsaw, nibbling machine or vertical shaper because it can be used for a variety of work that might be done on such machines. By making block *G* a loose piece and attaching it on the end of the clamp screw *I* and arranging a screw through one of the front legs to clamp the leaf, elongated slots and other shapes can be attained by drilling a "nest of holes" and subsequently finished by end milling. By making several variously dimensioned sets of trunnions to give greater loading space in the jig several pieces can be drilled at one time. To mill elongated slots of considerable lengths in thick sections of steel and "blind bottom slots" is an expensive job if the depth of slot is two or three times the diameter of the cutter. In fact, such jobs are practically impossible but with this jig to prepare the slots the work is not so difficult.

An additional example of the flexibility of this jig is in providing side drill bushings and other bushings through the leaf. Any of the drill bushings which are added in the jig body can be used for drilling holes in various places in the work because of the adjustable features of the jig.

Adjustable Arms For Drill Bushings

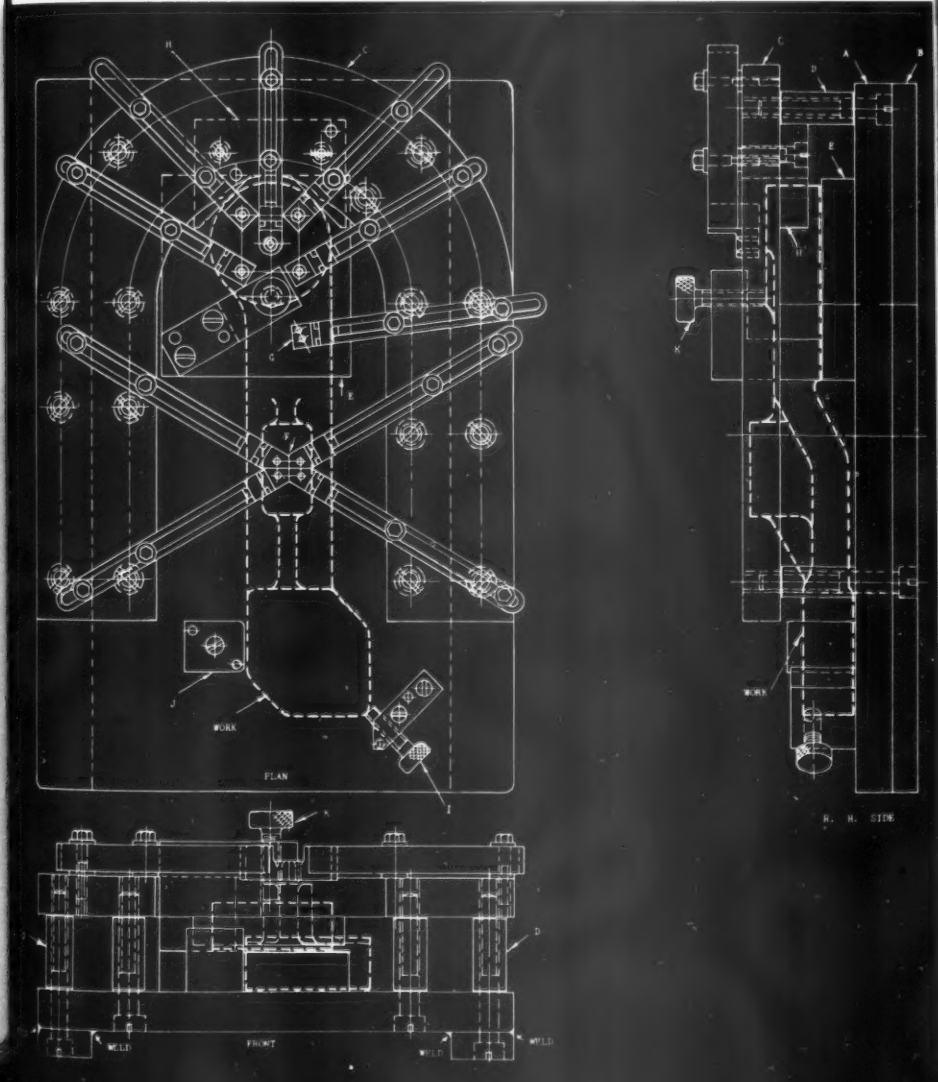
The arm with a section through its slot is seen in the top view of Fig. 119. The arm is made of $\frac{5}{32}$" x ⅞" cold rolled steel. It is first cut to length and bent U-shape and its ends are then squared. The arms are made of various lengths to suit individual cases of drilling. The width of slot *B* is about $\frac{1}{16}$" greater than the diameter of screw used through it for clamping. This provision permits considerable latitude of side adjustment when positioning the bushing before clamping the arm.

At *C* the arm is shown assembled with a bushing holder *F* and at *D* is an end view that shows clamping plates *E* removed to illustrate the method of clamping the bushing holder rigidly on the end of the arm. A bushing holder can be removed and another size substituted in five minutes. After assembly, a light grinding cut is taken over the entire lengths of the surfaces indicated by *G*. The assembly is self-contained and no projections are present to interfere with placing the arms as close together as pos-

sible, as suggested in the jig drawing Fig. 120.

There are many variations in the shape of the nose of bushing holder *F* to suit special cases when drilling holes close together. Normally the nose is made square as shown at *H*. Other convenient shapes are illustrated at *I* and *J*. At *J* the bushing holder is of tool steel and hardened. The holder carries no bushing in this case, simply having a "bell-mouthed" hole to guide the drill where the holes are too close to permit the use of standard bushings. At *K* is the "dropped" type of bushing holder. This design brings the bushing down

Fig. 120—An adjustable jig used for drilling miscellaneous types of work, either at single spindle drilling heads for a few parts, or in multiple cluster drill presses for many parts.



close to the work for accurate drilling. In other cases the arm can be elevated by using thick washers under it and around its clamping screws.

This equipment is not expensive to make. Clamp plates *E* and bushing holders *F* are milled from machinery steel in long sections and then pieces are cut to proper lengths. A small jig is made to drill the holes. Commercial bushings are used in the holders.

Adjustable Jig For Drilling Many Different Parts

The old saying: "Things are not always what they seem" has a practical counterpart in the tool shown in Fig. 120. The drawing of this jig suggests that the tool might be too complicated to build or use but this conclusion is far from the truth. Practically all the parts in this tool are commercial, there is very little machining to do, and the jig can be assembled in fifteen minutes.

The formidable looking drill bushing arms with their long slots are of the simple design and construction shown in Fig. 119. All the screws are of standard sizes. Base plate *A* and its feet *B* are of cold rolled steel and welded together. Adjustable plate *C* is U-shaped, made of 1″ machinery steel, flame cut or sawed, and has a light cut taken on its flat sides. The several spacer tubes *D* are made from wrought iron pipe and all their lengths must be equal. Plates *A* and *C* are clamped together and all the screw holes are drilled at one setting. Plate *C* can be raised or lowered to suit different heights of work by using different sets of spacer tubes, but this is seldom necessary because the work can be positioned for height by making plate *E* of suitable thickness. The work holding features are similar to those used in commercial "pump-jigs" which were shown in the July issue.

Attention is called to the group of holes drilled at position *F*. These four holders carry no bushings; they are made of tool steel and hardened and the drills are guided through the "bell-mouthed" holes in the holders. The noses of the four bushings are shaped to "cluster" together and the eight screws and washers that hold the arms down on plate *C* securely locate the bushings. All the bushings in the six other arms are of the "dropped" type shown in Fig. 119. At *G* we have two holes which are too close to be bushed separately so we resort to combining these holes in one hardened and ground holder.

The work is "centered" at one end by V-block *H*, is rigidly secured therein by screw *I* which also locates the piece against stop *J* and is held down on plate *E* by tightening screw *K*. To remove the work after drilling, all the fastenings are loosened and the piece is pulled straight out of the jig. For loading the jig the procedure is reversed. To set up the jig a master work piece is used which has previously been drilled in a jig boring machine. After locking the master within the jig the bushings and arms are located by inserting the proper size drill through each of the bushings and into the holes in the master.

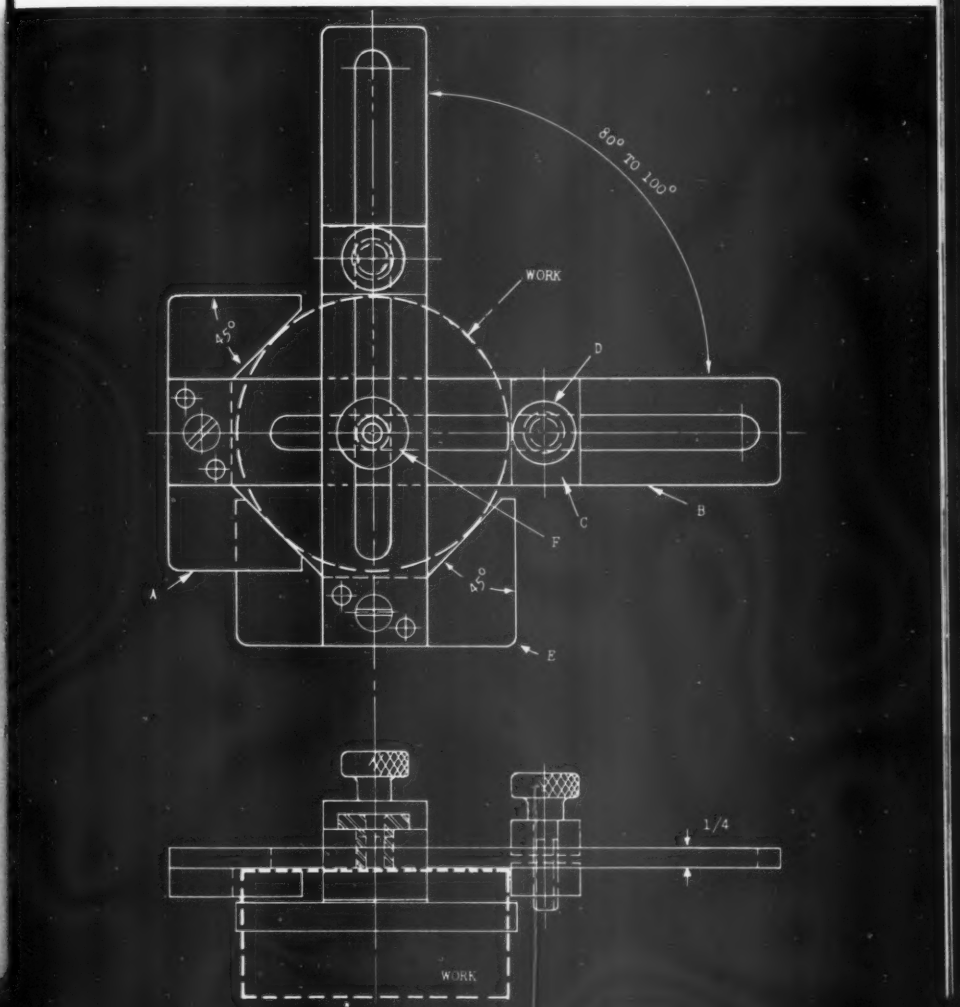
This jig can be built to any size that suits the work at hand. It has been used largely for drilling aircraft parts that are subject to frequent design changes. With this jig all such changes can be made in a matter of minutes and often without removing it from the machine. After making bushing holders for a large number of different piece-parts it is found that many of the needed sizes of bushings for drilling new work are on hand. The bushings and holders should be kept in a compartment cabinet with sizes stamped near them. This jig will drill flat plates or castings requiring holes at different levels.

A Self-Centering Drill Jig

Figure 121 presents a novel application of an old principle for drilling a center hole in round work and for spot-centering cylindrical work for lathe centers, etc. This job comes up in all machine shops every day. The old method of scribing two diametral lines across the work and then attempting to center punch and drill at their intersection is not accurate within .010″ to $\frac{1}{64}$″; but suppose it were "accurate enough", how could you justifiably drill center holes in 50 or 100 pieces in that tedious way? Better to do it with this "little machine" as it is sometimes called; we live in a "machine age" and hand work is "out" nowadays.

The operation of this tool is so very apparent from the sketch that little more need be said. V-block *A* is pulled forward against the circumference of the work by blade *B* and this action centers the slot over the work. Clamp *C* is then pushed against the opposite side of the circumference and locked by screw *D*. Next, the same procedure is followed in respect to V-block *E*. The angle between the blades is not critical as is indicated by the 80° to 100° dimension given on the sketch; but by making the angle either 90° or 120° the bushing can be also centered over square or, respectively, hexagonal sections. Bushing *F*, which is of special design with a leather friction washer under its shoulder, is then inserted thru the intersection of the slots, the diameter of the bushing body being equal to the width of the slots. The bushing is prevented from rotating with the drill by a spring pad arranged around the drill; the pad contacts the face of the bushing shoulder thus holding the bushing down against the leather washer before the drill enters. Spot-centering long shafts is done horizontally by using a hand or portable drill. Two or three sizes of this jig will handle all centering work in the average shop.

Fig. 121—Self-centering jig for drilling center holes in round pieces of work.



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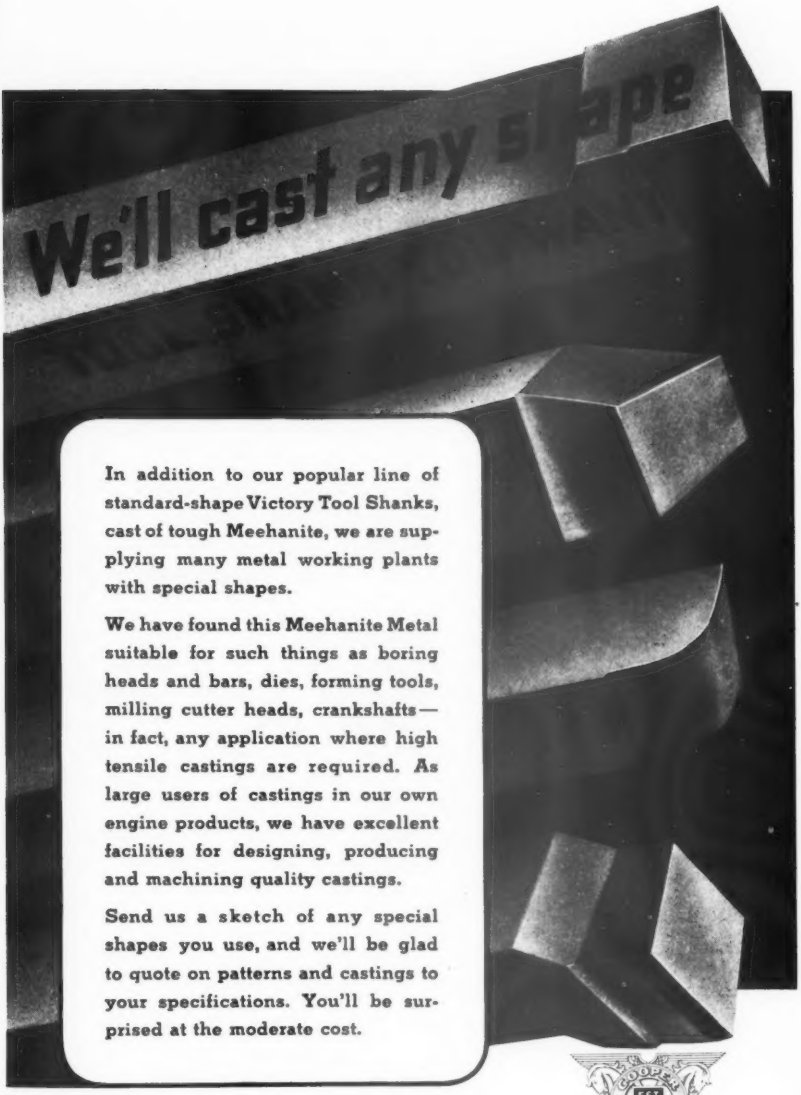

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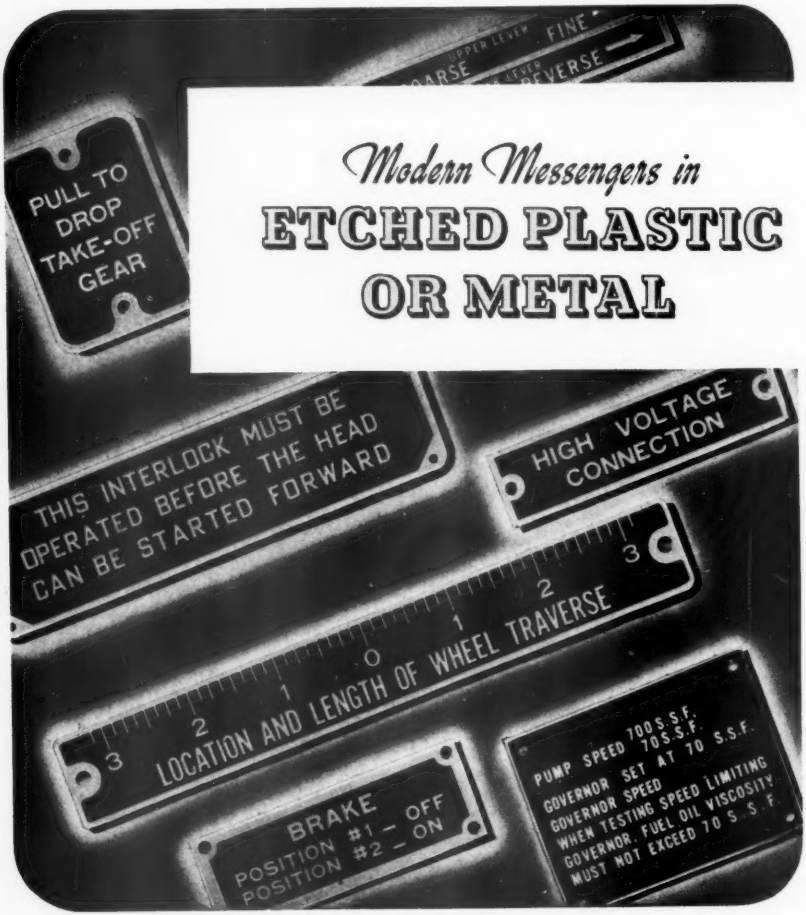
PULL TO DROP TAKE-OFF GEAR
THIS INTERLOCK MUST BE OPERATED BEFORE THE HEAD CAN BE STARTED FORWARD
HIGH VOLTAGE CONNECTION
LOCATION AND LENGTH OF WHEEL TRAVERSE
BRAKE
POSITION #1 — OFF
POSITION #2 — ON
PUMP SPEED 70 S.S.F.
GOVERNOR SET AT 70 S.S.F.
GOVERNOR SPEED WHEN TESTING SPEED LIMITING GOVERNOR. FUEL OIL VISCOSITY MUST NOT EXCEED 70 S.S.F.

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PLANNING AND ESTIMATING PLASTICS MOLDS

THE manufacturing operations by which plastics moldings are produced require careful and thorough planning and estimating. In the usual molding plant practice, a cost, or price quotation is submitted to a prospective customer as a competitive bid. The costs and means of producing a part exactly as specified must be accurately computed within close limits in order to meet competition, show a profit, and retain the customer's confidence in the molder as a dependable source of molded plastics parts.

The task of coordinating the planning and estimating may be accomplished efficiently by one plastics engineer who follows a job all the way through the various operations necessary to produce the finished part and consults, along the way, other persons in the organization whenever the nature of the job and his own experience require him to do so. One such coordinator usually is able to do the engineering on two or three complete jobs per week and to submit quotations

Gordon B. Thayer
Technical Consultant
For Plastics

and rough-draft planning for four to twelve more jobs which are in the preliminary discussion stages. His work consists therefore then of more than merely estimating. He has to plan how the job is to be done before he can estimate how much it will cost. He has to keep a record of the plan for use in setting up the job when the approval is received, and for following the job through to see that quality and costs are turning out as planned. His responsibility in planning also includes making sure that methods and estimated rates are approved by the management, by plant operating superintendents, and by the detail designers.

The specific jobs of the estimator are to set up the operations sequence required to produce the complete molded part, to do the engineering required for the equipment which is to be employed, to estimate the cost of the equipment and the cost of the molded part, and to coordinate generally to make sure the job can be and is accomplished as planned. For convenience in following through these duties it is advisable to set up a routine for planning and estimating.

An example of an estimating system will be described here. It includes an organization routine and some suggestions which may be used as guides in estimating tooling costs and production rates. The costs and rates for any specific plant are not likely to be the same as for another plant, and the estimator must build up his notebook of records from experience in his own plant.

Planning

The first step in planning how a molded part is to be produced is to gather all of the available information as to what is desired in the molded product. This includes a thorough study of drawings of the part and its exact tolerance limits, material and finish specifications. Often, the estimator's knowledge of plastics materials and manufacturing methods is required in suggesting changes in design or specifications to improve the product or to lower its cost.

Deciding how to mold the part and

selecting the type of mold are the next steps in the planning. Two general factors influence the selection of the mold type—the plastics material which is to be molded and the equipment which is available to manufacture the molding.

Thermosetting materials may require a compression mold or a transfer type mold, depending upon the nature of the material and of the molding. Thermoplastic materials may require a compression or a transfer mold, or, usually, an injection mold.

The mold type selected determines the style of the molding press, and the production rate requirements together with the physical dimensions of the molded part determine the size of the press. Another consideration in selecting molding press facilities is the backlog of work in the molding department. If there is any choice in selecting a press the selection should be made so as to distribute the total work evenly over the equipment available, thus to keep it all busy and not overload one press or department so much that it delays delivery of molded parts.

Other backlogs which should be considered are those in the tool room and in the finishing departments. Mold design features and finishing operations are usually so elastic that they may be modified without detrimental effects upon the quality or cost of the tooling and manufacturing. For example, the duplicating machines and milling machines in the tool room may have many weeks' work ahead of them, hence a multiple cavity mold which would otherwise be milled or duplicated might be specified as a hobbed sinking. Parts with round holes or threads may be made with the holes or threads molded, drilled, or tapped, according to the most expeditious layout of operations.

The next step in planning is to make a list of the operations which will be required to produce the finished molded part as specified. It is good practice to consult the various department heads involved for their opinions as to the best production methods because they are expert in their fields and because they are interested in maintaining the rates and quality which they promise the estimator when he is preparing the estimate. Time study records should be available for production operations already going on because such records are very useful as a guide in estimating rates for a new job. The estimator should consider all of the factors in setting up the estimate and operations sequence, and he should not necessarily follow the judgment of the individual superintendents especially if they do not have the whole job picture in their minds. The estimator should be the coordinator of the whole job and he should be responsible for seeing that individual items fit into the plan for the most efficient production conditions which he can establish.

After the mold has been tentatively designed, and the operations have been listed, special fixtures and gages should be listed along with the standard equipment which is to be employed in the manufacturing operations. Sometimes it will be necessary to sketch fixtures and gages in order to be sure to include all of the items of their cost in the estimates for the tooling. Usually, the fixtures are designed according to the practice preferred in the specific molding plant so there are previously used fixtures of similar design on record. When this is true, the design layout and cost estimate may be simplified to the point of using an existing design as a model, and the cost of the similar fixture as the estimated cost of a new one.

While the estimate is being compiled the estimator should consult management, department heads and detail designers for suggestions and approval. When the estimate has been completed it should go to the plant manager for final approval before it is sent to the sales manager. This is an important part of the procedure because the plant manager knows what the plant has already committed itself to do and he should review each new commitment for a final check to be sure that promises can be met without loss.

Details of the Cost Estimate

Computing the costs of materials, tooling, and manufacturing operations is often a laborious task which contains a great deal of arithmetical calculations. Thorough planning is therefore advantageous before the computations are begun in order to prevent useless, time consuming figuring.

After the design of the molded part

MOLD ESTIMATE													
	MATERIAL			HOURS									
PART	Kind	Size	Lbs.	Shaper	Lathe	Mill	Holes	Hdn.	Grind	Polish	Fit	No. Req'd	Total
Force													
Cavity													
Core Pins													
Force Plate													
Cavity Plate													
Backing Plates													
Ejector Pins													
Ejector Assm.													
Hobs													
Templets													
Loose Inserts													
Assembling													

Fig. 1

has been settled beyond probability of change, the weight of the part should be computed. The actual weight of the plastics material in the molded part itself must be determined accurately. If a model of wood or metal is available the computations may be simplified. If the model is made exactly to scale, of a homogeneous material throughout, its weight may be transposed to the corresponding weight of the plastics material. If the model cannot be used to determine the weight of the part then it is necessary to compute the volume geometrically. A table of the weights of various plastics molding materials is included here for convenience in conversion of cubic inches to pounds. In some items the range of weights is rather broad because of the nature of the material. In case of doubt, the use of the higher value will assure that the estimate will allow for enough material. For special materials it is best to base computations on the material manufacturer's recommendations. The weight table also includes the weights of some materials from which molds are often made.

In addition to the actual weight of the finished molding some allowance must be made for losses in the manufacturing processes. These losses may be partly recoverable or totally waste material. For thermosetting materials the loss is not ordinarily recoverable. Some of the material in the mold charge is lost as flash. Rejected moldings also represent a loss of material. A study of 20 typical compression molding jobs, taken at random, shows 9% to 55% as excess mold charge. The majority of the moldings were produced with a mold charge about 25% in excess of the final weight of the molded piece. Scrapped material produced during and after the molding operation may be as low as 5% for simple jobs and as high as 30% for more difficult jobs. Thus, for ordinary thermosetting materials, a total allowance of about 30% to 40% should be made for material losses.

For thermoplastic materials sprue scrap and spoiled moldings are recoverable and often this material can be re-

used for the same molding job by feeding the ground scrap back to the molding machines in proportions of 10% to 25% of used material with corresponding percentages of new material. Crystal clear materials are not usable as reground scrap on the same job from which they accumulated unless the scrap is kept absolutely clean and the best possible molding conditions are maintained, thus to avoid damaging the material by overheating, by using too much lubricant on the molds, or by a too rapid injection speed which causes burned spots. Even so, the reuse percentage for clear material is rather low.

Clean, uncontaminated and unmixed recovered thermoplastic scrap material of known brand and specification can be sold to clearing house outlets or can be used for suitable products which may be manufactured for direct sale by the molding plant. Mixed scrap of a given variety is also salable for reconditioning as darker colored or black material. The actual waste loss for thermoplastics can be kept around 5% by control of operating and handling conditions.

The cost of metal inserts for molded parts should not be neglected, and it should be understood definitely whether the customer is to supply them or the molder is to obtain them from sources of his own choosing. It is usually more economical for the customer to supply the inserts as he thus avoids the handling charges which the molder may have to add as part of his overhead burden.

Estimating the Mold Cost

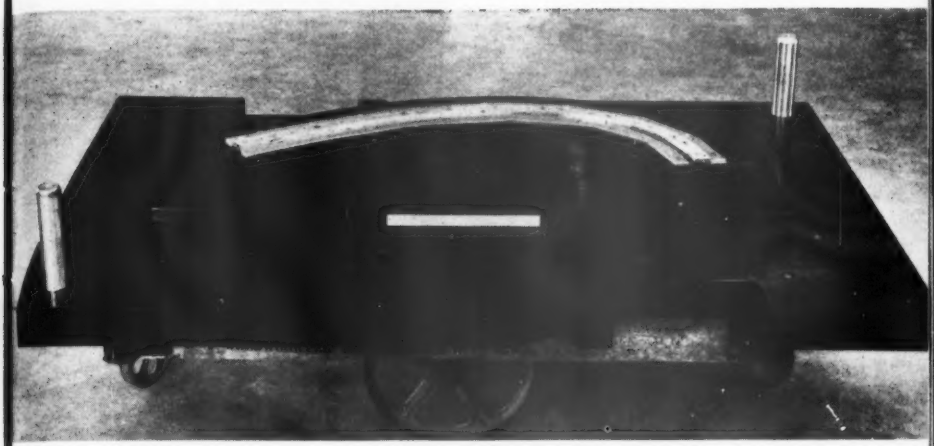
Perhaps the most detailed method of estimating mold costs is to visualize each mold part and itemize the operations required to produce it. Breaking down the operations to their elementary items and then estimating the time required for each item is likely to produce the most accurate estimate. This method requires a considerable amount of time and for this reason the estimating routine is often simplified by experienced estimators. One example of a simplified estimating form is shown by Fig. 1 which shows the machine and hand operations across the page and the mold parts in the vertical column. This form is merely typical and it does not necessarily represent the most convenient form for any individual estimator. In some cases, as for example when only compression moldings are estimated, the list of parts would be more specific and compression mold parts would be more extensively listed. Other information might be added to the form such as customer's name, part number, and molder's part number, press number, etc., according to the preference of the estimator and the requirements of the records system.

Tool room methods vary and for this reason it is not simple to tabulate the time requirements for various machining operations. The best way to accumulate such records is to take them from the tool room job cards. For example, round cavity blocks with simple mold contours may be produced in a lathe almost completely. The operations of turning, contouring, laying out templets, hardening, grinding, fitting, and polishing can be traced through the job cards and summarized in a short time for any individual piece. By tracing the time involved for a few typical parts, the estimator can build up in his mind an idea of how much time is required for the operations listed on the estimating form.

The mold is usually the greatest single item in the tooling costs. However, the various fixtures should be included in computing the tooling cost. Most fixtures for plastics are simple though rugged. The production of war materials has necessitated the use of precision fixtures and gages for plastics, and precision work costs more than ordinary work. Fixtures and gages may be estimated roughly from the costs of existing fixtures, but if extra precision is to be required, or if the cost is likely to be more than $50, a more completely itemized tabulation should be made.

Estimating Production Rates

Production rates may be grouped according to typical jobs. Compression molding on large presses, small presses, involving heavy sections or thin sections of plastics material exemplifies job grouping for kind of operation. After the operations have been grouped, the time required to perform them may be taken from the time study records with the additional assistance of the detail drawings of the parts involved and experience with the various operations.



Large die having severely shrunk flange closed approximately 20°.

(Continued from Page 96)

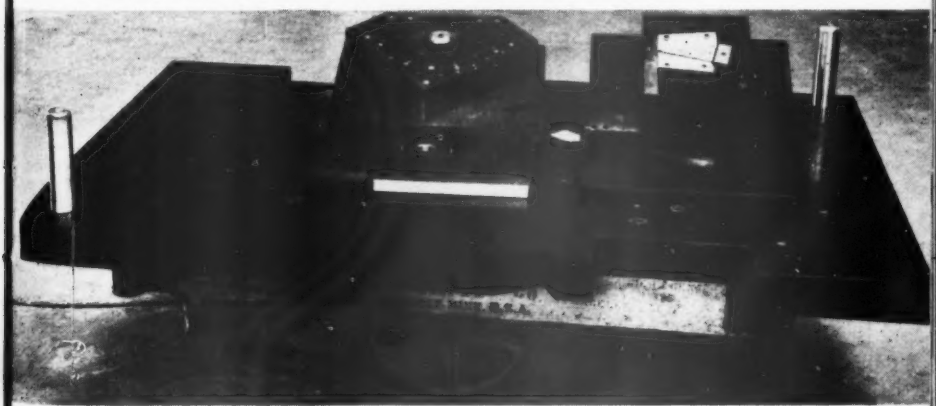
Where plastic dies may advantageously be employed today's acute manpower situation is thereby relieved. Since this is a forming process rather than a molding process much plastic die work can be handled by relatively unskilled labor and trainees as the materials are easy to work.

These new dies make it possible for any firm with a mechanical press to manufacture formed parts for assembly. Forming and assembly in the same plant at marked economies in handling time and costs is of appreciable benefit. Since hydro-presses have been so over-loaded this utilization of many available mechanical presses for parts forming relieves a critical bottleneck in aircraft production.

Fabrication and Engineering

In fabricating a plastic die a low cost, high strength lignin plastic such as Masonite Die Stock is used for backing

Two small form dies. Note left hand die has inset in stripper for forming flanged lightening hole. Right hand die has 15° closed flange formed in one operation.



plates, die blocks and most strippers. The innovation that makes these dies by Cook Engineering "all plastic" is the introduction of laminated phenolics for probably the first time in die making. This material is used as forming rails and punches so that other than screws, pins and springs, no metal is required. Occasionally, very narrow strippers are developed from steel.

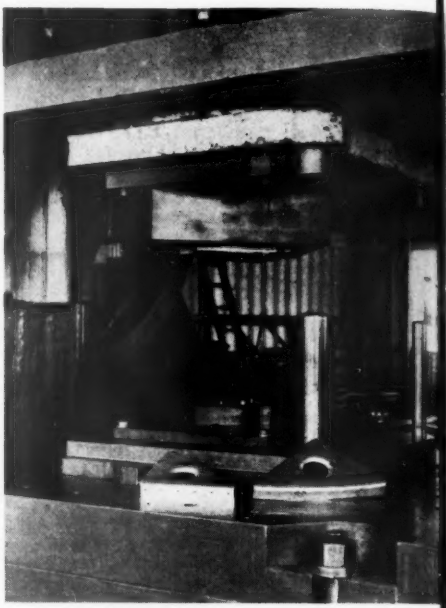
In the production shop the work is begun by the usual layout department. Starting first with the layout template and for the form block template, the original layout is planned. The templates are developed from either or both engineering drawings and aircraft design drawings.

Secondly, the laminated plastic is rough-cut to pattern and forwarded on to sub-assembly where laminated phenolic punches enter the line, die blocks are set up and the rails are then fitted to the punch. The final operation here is the bonding of all laminations in the die block into one unit.

Final assembly begins with preliminary fitting by index dowels. The top laminated rail supports are fitted to the die block and rails and then the rails are installed in the die block. The completely assembled die block is fitted to the backing plate and all dowels and screws are inserted after final lamination. A protective coating is applied which seals the die stock and prevents oil saturation when in production. The coating also increases dimensional stability and aids hardness.

These plastic dies are being produced with tolerances as close as plus or minus .003" and part tolerance of $\frac{1}{32}$". They show a surprising surface hardness, have a low co-efficient of expansion, are highly abrasion and shock resistant and have compressive strength beyond that of steel. The all plastic dies have proven particularly suited to "form and draw" die combinations as they require no second operation or hand working, even on closed angle forming. Such severe single operation forming is accomplished by an ingenious application of synthetic rubber and requires no mechanical cams.

Since it has a certain resiliency the plastic die will not scratch or damage coated metal stock. Often ordinary forming processes with steel dies will coin such a surface dangerously, thinning the delicate protective coating enough to allow corrosion or to necessitate a re-application of protective finish. Plastic dies will actually spring away from the metal rather than mar it.



Die and small die set. Note perfect parts shown exactly as struck. No wrinkling on shrink flange. No coin marks or scratches.

From the engineering standpoint the major problem is that of the proper laminating and supporting of the die stock to cover reduced shear and tensile strength. After exhaustive testing the only limitations that are apparent in plastic die applications are those imposed by the capacity of the existing mechanical presses. As for length of run the upper limit of plastic die life is not known. The maximum known service to which any of these dies has been put is 7000 parts after which close examination shows no wear. It is estimated that runs of at least 50,000 parts are feasible with plastic working surfaces in the forming of soft steel or aluminum alloy shapes.

Industrial Digest

TOOLING • PRODUCTION • WAR NEWS • PUBLICATION REVIEW

Broaching Replaces Sawing

An interesting broaching operation is illustrated in the production of electrical contact pieces, two of which are to be held by spring tension against a carbon rod fed between them.

The contacts are made from nickel steel blocks and were formerly produced by rough-drilling a hole through the block (Fig. 1), hand-reaming the hole to size and then sawing the block apart which resulted in two properly shaped contacts. Considerable hand work was next necessary to remove all tool marks and burrs.

Two wing-shaped broaches now do the job. As the first broach is drawn through the rough-drilled hole it both sizes the hole and partially severs the block (Fig. 2). After completion of a quantity the machine set-up is changed to the second broach. This broach does no cutting in the already sized hole but simply completes the severing of the block (Fig. 3). The previous sawing operation is eliminated and only a small amount of buffing upon assembly is needed.

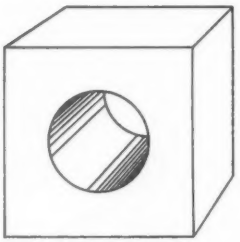


Fig. 1

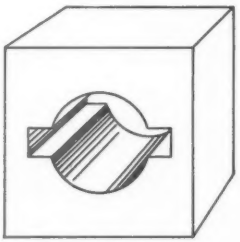


Fig. 2

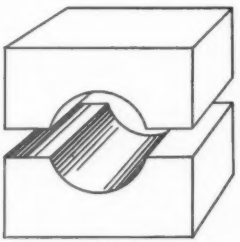


Fig. 3

INDUSTRIAL DIGEST

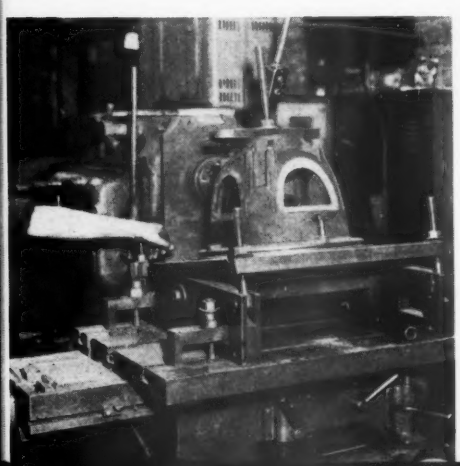
Precision Tool Standards Being Studied

A proposal of standards for precision measuring tools was made at a meeting of the Precision Tool Industry Advisory Committee with W.P.B. and other government representatives in Washington.

Task committees of precision tool engineers and industry technicians were named to confer on standards for four categories of precision tools, i.e., tool room specialties, micrometers, dial indicators, and miscellaneous precision tools. Steps already taken by individual firms will be incorporated.

End Milling of Surfaces Speeded

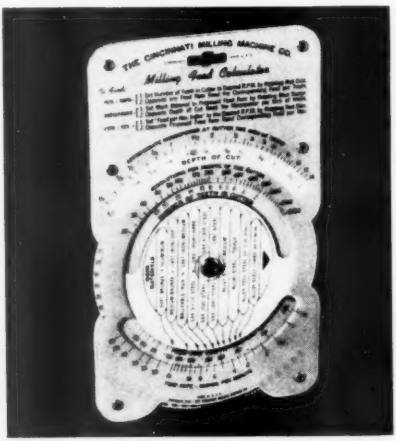
An adjustable holding fixture is illustrated which reduces set-up time and facilitates the end milling of surfaces at various angles to the vertical. The fixture consists of a work-supporting plate trunnioned between two parallel pieces which form the base. The ends of the base members are shaped to permit tilting the plate to the desired angle. Bolts in each corner serve to adjust and lock the plate in position.



Milling Speed-Feed Calculator

In keeping with the times and the War Production Board's program on the conservation of cutting tools is the calculator designed by Cincinnati Milling and Grinding Machines, Inc., Cincinnati 9, Ohio. The price of the calculator is 50c.

The Cincinnati Milling Calculator will aid you in quickly selecting the correct cutting speeds and feed rates for many milling jobs. The size and kind of cutter, the work material, depth of cut, cutting speed, feed rate and required horsepower are all calibrated on the dials of the calculator. By properly setting the dials for each situation you can determine the most effective combination



of speed and feed from the standpoint of power, tooth load and finish. The ranges of variable factors covered by the calculator are: Cutter Diameter, ⅛" to 15"; Rpm, 20 to 2000; Cutting Speed, 200 to 4000 fpm; Cutter Material, i.e., Carbide, Carbon or HS Steel; Depth

of Cut, 1/32" to 2"; Approx. horsepower at cutter per inch of width, ¼ to 14; Number of Cutter Teeth, 2 to 40; Feed per tooth, .0005" to .025"; Feed per revolution, .001" to .500"; and Feed Rate, ¾" to 60" per minute, for alloy steels, tool steel, cast steel, cast and malleable iron, and brass, bronze and aluminum.

Accident Prevention

Tightening or removing large nuts underneath flanges of heavy machinery was a difficult and often dangerous job until a safety device was suggested by G. E. Machinist Samuel Solini. Because some such nuts weigh 75 lbs., a crane was previously used but the nuts could not always be held steadily while being started and a worker might have one fall on his toes. Solini's device, for which he received a $75.00 award through the company's suggestion system, is hooked into the nut on the top side of the flange. The length of the vertical bar and the "reach" of the horizontal lever arm are adjustable to the size of the flange by means of pins and holes. The coupling in the vertical bar permits free rotation of the lower portion of the tool and the plate at the end of the lever arm on which the nut is placed is pivoted so that it may turn with the nut.

The ring holding fixture is mounted on the lathe carriage and the boring bar extends from the headstock spindle. The ring is clamped to the fixture table by quick-acting toggle clamps and the table can be indexed for the drilling, boring and chamfering of the successive holes.

Lathe Fixture for Horizontal Boring

The problem of precision-boring a number of holes around a large ring on a production basis was solved by a lathe fixture readily devised to get the job done when the necessary boring mill was unavailable.

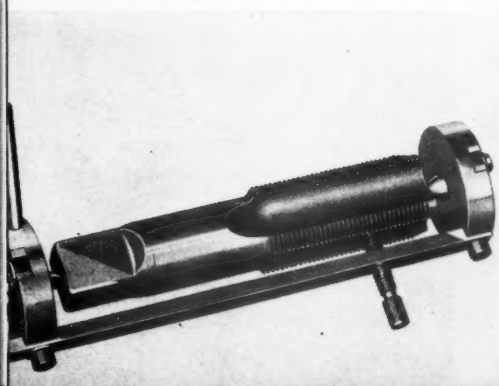
PROGRESS ON P

TO solve the problem of regrinding taps to any degree of chamfer and relief, thus putting them back into service, is the purpose of the Minn-Kota Tap Grinding Tool (below, left). There is an adjustable bar in a slot on the outside of each end of the tool in which the center points of lathe or tool grinder are centered. They are marked for adjustment by $\frac{1}{64}$" and when set off center as desired, the inside center points holding the tap give it just the right eccentric swing for grinding chamfer and relief on each flute of the tap, all identical. The tap is rotated and set screw tightened for each flute. For details, write Minn-Kota Manufacturing Co., Dept. TJ, Fargo, N. D. **803-D**

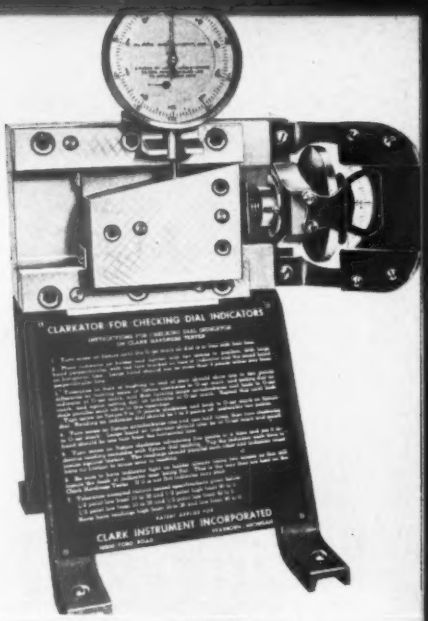
THE new Mead Pneumatic Collet Fixture (below, right), for drill, milling and similar applications, provides a powerful and accurate grip on round, hexagonal or square work. Maximum capacity of this fixture, known as Model C-18, is 1" round, $\frac{23}{32}$" square, $\frac{7}{8}$" hexagonal. A hollow ram through which a depth rod of required length rests on the machine table, clear of moving parts, provides accurate depth stop. The fixture is furnished with an adaptor for connecting the ram to any standard draw-in collet up to 1" capacity; a corresponding closing-ring is pressed into the top of the housing. For further details on Model C-18, write Mead Specialties Co., 15 S. Market St., Dept. 103-HA, Chicago, Ill. **569-D**

A RECENT development of the American Broach & Machine Co. is the American Keyway Broach Pull Head No. 1 (bottom left, opposite page). It was developed primarily for pulling keyway broaches of virtually all sizes, but it can also be utilized to pull rectangular, oval or any other shaped broaches. Operation can be manual or automatic, depending on whether the broach must be disconnected between cuts. The use of this pull head reduces breakage and eliminates the need for various size thread pullers since an adaptor, as shown in the foreground of the photograph, can be attached to the end and locked by means of the lock nut shown. Write the American Broach & Machine Co., Ann Arbor, Mich., for complete information. **708-D**

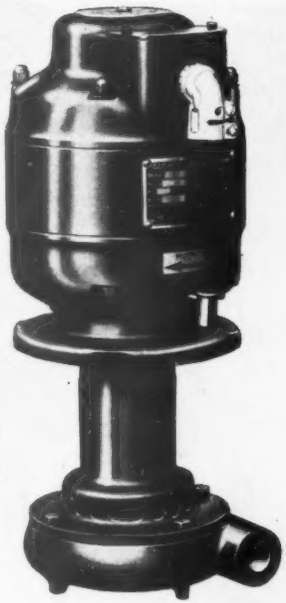
WEDDELL TOOLS, INC., of Rochester, N. Y., has applied a new type of cutter blade (bottom right, on opposite page), known as the Tri-Bit, to face milling cutters. Tri-Bits are triangular-shaped adjustable tool bits, each of which is securely locked home in a vee-shaped hole in a heat treated cutter body by a single lock screw. Because there are no slots to spring or tear open, the cutter body is tied together all around the blade. The triangular shape further offers the ultimate in design for chip clearance as there is no heel on the blade to catch or clog chips. Information will be sent by writing Weddell Tools, Inc., Dept. WJ, Rochester, N. Y. **804-D**



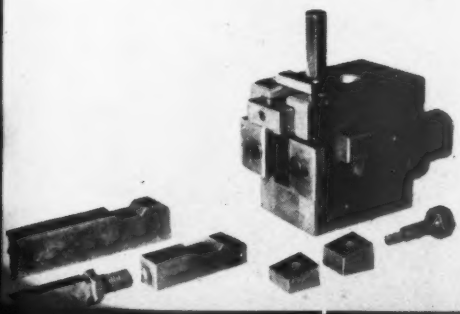
N PARADE



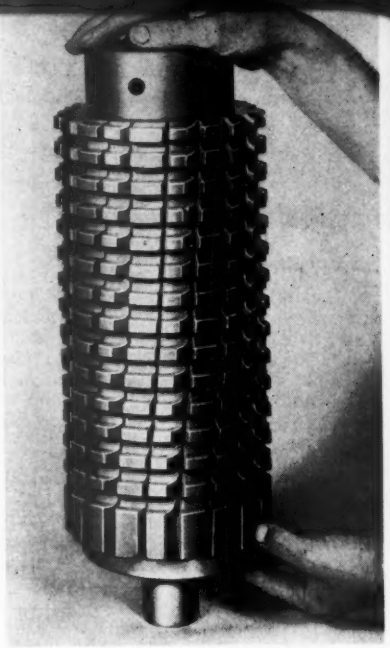
THE "Clarkator", a new device for checking the accuracy of dial indicators, was recently announced by Clark Instrument, Inc., of Dearborn, Mich. This instrument employs the sine bar principle, checking against the tangent of the angle. The Clarkator is said to be suitable for receiving and periodic inspection both of the standard direct reading indicator and the reversed reading indicator used on Rockwell hardness testers. The front angle is used when checking standard indicators, each revolution of the screw equalling .020" and each point on the dial .0002". The back angle provides a direct method of checking hardness tester indicators, each revolution of the screw equalling .01962". Further information is available from Clark Instrument, Inc., 10200 Ford Rd., Dearborn, Mich. **120-D**



THE photograph, right, is a new immersed type motor-driven Gush Pump which was recently developed by The Ruthman Machinery Co. of Cincinnati, O. It is equipped with integral flange bracket for reservoir cover or bedplate mounting. Designed for installation interchangeability with Gusher Model 1-P3 Pump, this unit is available in any current characteristics, including 25 cycle and 1, 2, or 3 phase. The ¼ hp operating motor is full ball bearing, totally enclosed with one-piece rigid shaft which extends to the pump impeller. Complete information on Model No. 9040 can be obtained by writing The Ruthman Machinery Co., 1808 Reading Rd., Cincinnati, O. **318-D**

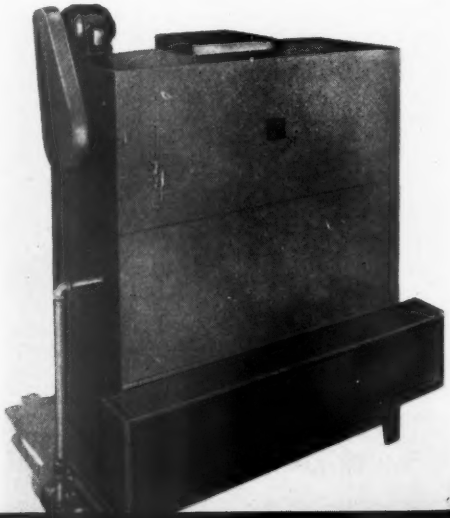


THE engineers of the Plan-O-Mill Corp. have facilitated the threading of gun tubes, breech blocks and other internal and externally threaded parts up to 16" in diameter by developing one of the largest multiple thread milling cutters (right) ever produced. It is 12¾" long and 6½" in diameter. It also provides the Higbee cut, by which the imperfect thread is removed coincidental with milling the thread. Production of this size cutter was previously almost impossible. Plan-O-Mill engineers, however, solved the problem by segmenting the cutter. This provides a spiral gash cutting action for smooth milling and improved work finish with straight fast grinding. Information is available from the Plan-O-Mill Corp., 1505 E. Eight Mile Rd., Hazel Park, Mich. **65-D**



DEVELOPED as a result of many years of experience, the Lacey Portable Die-Set Machine (below, left) is a proven timesaver because of its ease of operation. It enables the die-maker to complete a die-set right at his bench and assures faster, truer punch-to-die alignment. With the die-shoe clamped to the table and the punch-holder fixed in position in the ram, the punch can be removed as often as needed without disturbing alignment. The punch and die may also be separated easily without the use of a pry-bar or hammer. A folder will be sent on request by Moore Special Tool Co., 740 Union Ave., Bridgeport, Conn. **589-D**

DRAYER & HANSON, INC., announce the addition to their Wat-R-Miser line of a new evaporative condenser (below) with built-in air filtering. These units effect heat transfer by means of water evaporation in a continuously moving airstream. They are adaptable to a wide variety of industrial applications such as cooling batch quenching fluids, cooling oil for large Diesels, cooling jacket water, etc. Drayer & Hanson, Inc., 742 E. Pico St., Los Angeles 21, Calif., will send their 16-page, illustrated catalog on request. **816-D**



THE Cone Drive Division, Michigan Tool Company, announces a line of standardized, industrial turbine reduction units. Built around the use of area-contact, double enveloping Cone Drive gearing, these units are more compact than would be possible with other forms of right angle drive gearing of equal load capacity. They are being made available in 26½ and 37 hp base ratings. The former is the output rating of a 4½" Cone Drive center distance unit, while the larger unit has Cone Drive gears of only 6" center distance. **47-D**

A NEW type of cutting tool has achieved a 50% saving in high speed tool steel and 3 to 10 times longer life. This cutter is based on a radical new principle of tool design, featuring triangular-shaped bits which are held firm and rigid by a triangular seat in the tool holder. This combination eliminates vibration and tool chatter in the holder. Write Triangle Tool Co., 2108 E. 22nd St., Cleveland, O. **807-D**

NATIONAL METAL CONGRESS WAR CONFERENCE DISPLAY

WAR Production, Conservation and Post-war Planning keynote the afternoon and evening sessions of the 25th annual National Metal Congress and War Conference Displays held this month in Chicago's Palmer House.

These practical sessions were planned in addition to the formal presentation by the American Society for Metals of thirty-seven technical lectures.

In the conservation bracket the salvaging of metal including the recovery of battlefield scrap was up for discussion as a problem of immediate concern. This includes the use that can be made of aluminum and brass cartridge scrap along with the saving and disposal of tool steel scrap including grindings.

Discussion of the purchase of steels on expected performance which is the European practice rather than on chemical analysis as prevails in this country was scheduled for one of the opening evening sessions of the Metal Congress.*

Cooperating with the American Society for Metals in presenting this Metal Congress, the American Welding Society, the Wire Association, and the American Institute of Mining and Metallurgical Engineers, Iron and Steel and Institute of Metals divisions all offered technical programs of vital interest to the metals world.

The entire Metal Congress combines to present annually a patriotic "open sesame" metals laboratory where the research and developments of the past year may be placed at the disposal of industry to facilitate greater war production.

*See "Jominy Hardenability Test Predicts Steel Performance", page 94.

DUE to skilled engineering and precision manufacture, Erickson provides a collet which is open slotted at both ends, thus allowing the collet to collapse equally throughout its length and at the same time maintain accuracy, gripping power, and efficiency with wear, as the mating surfaces wear to continuous gage fits. The collet grips the tool shank at eight points instead of the usual three; permitting heavier feeds without vibration or loosening. This construction also allows the collet to collapse at least $\frac{1}{32}$" and still maintain its grip and accuracy. Erickson Steel Co., 2309 Hamilton Ave., Cleveland, O., welcomes calls on the facilities of their research and engineering service when special problems arise. **556-D**

KOLD-HOLD sub-zero machines used throughout industry for shrink fits, stabilization and aging of metals, tensile strength tests, and all other processing requiring sub-zero temperatures at —75° F and —90° F, extract heat fast, speed up production. They are exceptionally rugged in design, built for heavy duty

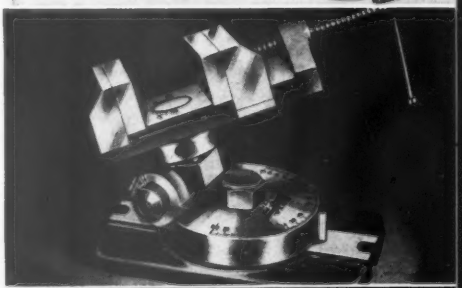
factory operation, are entirely self-contained and require no recharging or refilling.

Model 505T75, shown, and its companion model 1105T75, provide the two capacity requirements in the —75° F range. Models 105T90 and 505T90 cover the —90° F temperature range. Kold-Hold Mfg. Co., 445 N. Grand Ave., Lansing, Mich., offers an engineering service to determine which capacity and which temperature range are best suited to your particular requirements. Send for catalog and complete details. 84-D

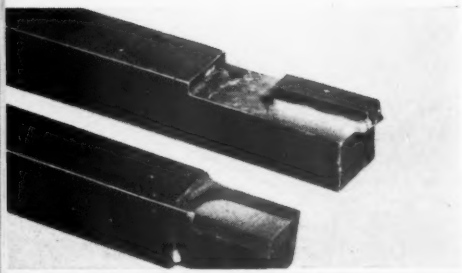
THE speed and ease of operation of Di-Acro precision machines makes them ideal for use by women in making duplicated parts accurate to .001". In the illustration, the operator on the left below is resizing stock material to channel size with the Di-Acro shear. To arrange the shear for this type of work, the operator simply adjusts the shear guides to provide the desired material width. She can then proceed rapidly to duplicate each piece. The center operator is creating non-stock size channel with the brake, from the resized stock material. The operator on the right is using the bender to form different degrees and amounts of both right and left hand radii, with the channels formed both inwards and outwards. A simple shop-made conversion provides the two desired different radii of forming. Degree of radii is controlled by the adjustable stop. She can then readily and economically duplicate the part at a high hourly output on a production basis. O'Neil-Irwin Mfg. Co., 315 Eighth Ave., S., Minneapolis 15, Minn., will send further details. 20-D

DISPLAYED by the Berco Manufacturing Co., 433 W. Superior St., Chicago, Ill., manufacturers also of the Hilco Cutter Grinder, is the new Hilco All-Angle Vise. Adjustable in three planes about three axes of rotation it has all the freedom of positioning required of a universal work holding fixture. The vise may be quickly and easily bolted to a machine table through hold-down slots and has positive locking means for any desired work position.

THE Por-os-way wheel, manufactured by A. P. DeSanno & Son, Inc., 404 Wheatland St., Phoenixville, Pa., was the product of several years of research instituted for the purpose of improving grinding wheels. The structure is entirely different from that of usual wheels,



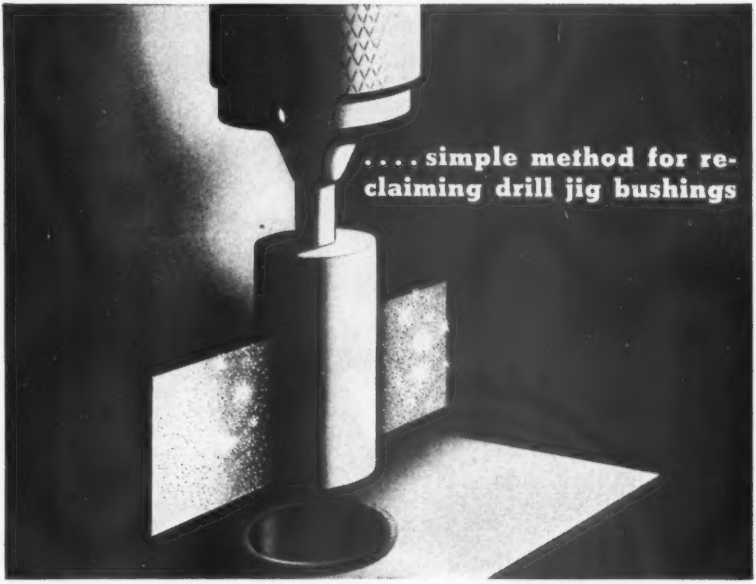
resembling closely a sponge in appearance. Instead of the abrasive grains being close together, the wheel contains millions of air cells which surround each grinding point. The effect of the air cells is to cool the grinding point after each contact with the work with the result that both wheel and work stay cool. Because of its coolness, this wheel will take deeper cuts at the customary feed or usual cuts at an increased feed. More about the Por-os-way wheel may be obtained from the company. **262-D**



THIS year the Eutectic Welding Alloys Co., 40 Worth St., New York, N. Y., presented a large variety of tools which have been produced or salvaged with the Eutectic Low Temperature Welding Process. With this process, broken tools are put back into production with only a few hours interruption. In tool production, too, Eutectic has permitted savings of carloads of alloy steel. Drills, broaches, milling cutters, etc., are made by inserting high speed steel and tungsten carbide pieces in shanks made out of low carbon steel. Such tools have shown long life because of the lower heat used when joining various grades of steel together. **81-D**

FEATURED in the George Scherr Company Exhibit is their Limited Budget Inspection Laboratory. This consists of a series of inspection tools and gages such as the Wilder Projector, Scherr Comparitol, Ultra-Chex Gage blocks and others which have been selected not only for their outstanding precision workmanship but also for their reasonable price. Latest development in the Scherr Inspection line, the new Scherr Gear Tester, was introduced to the metal trade at the Exhibit. Full information on all Scherr measuring tools can be obtained from the George Scherr Co., 128-B Lafayette St., New York, N. Y. **490-D**

SPOTLIGHTED among the Wilson Mechanical Instrument Company's array of "Rockwell" Hardness Testers is their Model 3-JR equipped as shown here with the No. 7 Vari Rest. This accessory facilitates taking hardness readings on specimens when there is the problem of weight overhang. The Vari Rest incorporates adjustable supports for the sample in combination with a movable counterweight which insures that the work being tested will be freely at rest while the reading is being taken. Address the company at 381 Concord Ave., New York, N. Y., for further information.



Information furnished by an Industrial Publication

The interior surface of drill jig bushings can be injured in several ways: by galling, burning, or seizing of the drill. In one manufacturing plant a simple but very effective method has been developed for restoring the surface by honing.

The equipment consists of a mandrel and a piece of abrasive cloth. The mandrel can be made from scrap rounds or cut-offs. The body is turned down to a diameter slightly less than that of the bushing, and the shank machined to fit into a conventional drill chuck.

The body is slotted at the bottom to take a piece of abrasive cloth somewhat wider than the depth of the bushing. The cloth is wrapped around the mandrel and the assembly started in the hole before power is applied.

If a coolant or oil lubricant is used, the bushing can be "honed" by moving the mandrel up and down as it rotates. As the hole enlarges, or as the "gall" is removed, additional pieces of abrasive cloth can be caught under the original piece to enlarge the hole still further.

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SALES AND TECHNICAL LITERATURE

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LUFKIN PRECISION TOOLS—Well illustrated by detailed diagrams and photographs, Catalog 7 contains a wealth of information on the extensive high grade line of micrometers and other precision tools manufactured by Lufkin Rule Co., Saginaw, Mich. General descriptions and construction features

of micrometer calipers, depth gages, bevel protractors, die makers' squares, etc.; directions for reading verniers to thousandths and ten thousandths of an inch; adjustment hints; numerical and alphabetical indexes—all contribute data to make this catalog one of value to the experienced shop man, student or "green" employee. **609-D**

WHERE ACCURACY IS ESSENTIAL—Milwaukee surface plates, angles and box parallels have become indispensable in the modern tool room and inspection department. These surface plates are rigid in design and are made of close-grained semi-steel, specially treated to overcome strains and distortion after machining and scraping. The same careful treatment is applied to the angles and parallels, making them durable and accurate tools. Complete details and specifications are available in Bulletin 109 from the J. C. Busch Co., 172 So. Ferry St., Milwaukee, Wis. **94-D**

FIRST AID FOR THE TOOL ROOM—Seven standard kits, each containing a logical assortment of interchangeable counterbores, pilots and holders, are illustrated, described and priced in a new bulletin by Gairing Tool Co., Dept. TD, Detroit, Mich. **800-D**

THE NEW PROCUNIER TAPPING ATTACHMENT—is the subject of a bulletin published by the Procunier Safety Chuck Co., 12-14 S. Clinton St., Chicago, Ill. Also included in this circular are details and specifications on the new Procunier "Tru-Grip" Tap Holder which is standard equipment on the tapping attachment. Write for your copy of Bulletin 543 now. **623-D**

NEW BRIGHTBOY CATALOG—Gives full particulars on the application of Brightboy—where it serves, its actual uses from the production line and suggestions for using it. This amply illustrated catalog also gives full specifications. For your copy of Catalog No. 56, write Brightboy Industrial Division, Weldon Roberts Rubber Co., Dept. 10-J, Newark, N. J. **668-D**

OLIVER OF ADRIAN PRODUCTS—This new folder consists of five individual bulletins covering the Oliver Drill Pointer, Ace Universal Tool and Cutter Ginder, Template Tool Bit Grinder, "Arc" Face Mill Grinder and the Die Making Machine. The Oliver Instrument Company, Adrian, Mich., will send copies on request. **697-D**

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THE TOOL & DIE JOURNAL
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SUPER CARBIDE TIPPED TOOLS—a new general catalog by Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich., contains—in addition to the tabulation of prices and specifications, views of their new and up-to-date plant, photos and line drawing of special tools,—tables giving decimal equivalent of drills; recommendations for machining steel, and a Comparative Grade Chart for Tungsten Carbide Cutting Metals. A comprehensive section on Special Tools contains among others, a Hardness Conversion Table, Table of Decimal Equivalents, official SAE Steel specifications for carbon, free cutting and manganese steels. Make requests for this catalog on company letterhead. **168-D**

FINE PRECISION TOOLS—by Rivett Lathe & Grinder, Inc., have design and workmanship built into them supported by many years of experience. Read about Rivett tool room lathes, internal grinders and hand screw machines in Bulletin 500. Available from the company at Brighton (Boston) Mass. **655-D**

UNIVERSAL NUBON GRINDING WHEELS—In the interest of standardization and to enable the user to visualize at once the wide range of types of grinding wheels, Universal Wheel & Abrasive Corp. shows in their comprehensive catalog cross sections of the nine standard types which are representative of practically all grinding wheels used on the standard makes of grinding machines.

The nine types of wheels are numbered and each dimension designated by letter. This classification of grinding wheels greatly simplifies the stocking of wheels wherever a quantity is kept on hand. The catalog, complete with list prices, is available from the company at 2626 Van Buren St., Chicago 12, Ill. **656-D**

FOUR SPEEDS AND AUTOMATIC STONE FEED-UP—make the Sunnen Precision Honing Machine ideally suited for many applications such as assembly operations, tool room and experimental work, short run production, repair and salvage work. Illustrations in Bulletin PHG-626 show typical uses of this honing machine. One of the most important features claimed by Sunnen Products Co., 7947 Manchester Ave., St. Louis, Mo., for their machine is the simplicity with which a truly cylindrical surface is produced. To better illustrate this ability of the Sunnen machine, photomicrographs and profilographs of various finishes of cast iron are shown. Rough bored, followed by partial Sunnen honing, reamed, precision bored and Sunnen finished and polished honed surfaces are compared. **583-D**

"FAST, ACCURATE MAKING OF METAL PARTS"—a descriptive folder by Mercury Metal Die & Letter Co., Inc., 546 E. 16th St., Los Angeles 15, Calif., gives details and specifications for their hand and press style holders. The Mercury Type holder stamps the entire part number—up to 16 characters if needed—with just one blow of the hammer. This and other features are treated in the folder. **657-D**

"A BIG VISE FOR THE BIG JOBS"—says Ross about Rousselle Victory Vises in Bulletin 643 . . . and then goes on with complete details. One of the greatest advantages claimed for the vise is the tremendous saving in set-up time With complete graduations around the entire dial on the broad, plainly visible swivel base dial, the operator can quickly, easily and accurately set the vise at any degree. The Bulletin, available from David J. Ross Co., Benton Harbor, Mich., also covers Rousselle punch presses and adjustable spacers. **160-D**

"MILWAUKEE ARBORS" prepared for the ready selection of proper sizes and types of arbors for your milling machines, contains 10 helpful suggestions on how to prolong arbor life, maintain precision and trueness, detect distortion and springing, and secure maximum milling efficiency. In addition to a very complete list of standard arbors for both the new and old models of milling machines, it contains detailed specifications, descriptions and prices of collets, adapters and centering plugs for this same equipment. Catalog 42D is available from Kearney & Trecker Corp., Dept. J, Milwaukee, Wis. **592-D**

AN INTRODUCTION TO THE AGERSTRAND CORPORATION and their extensive engineering and manufacturing services is available in booklet form from the Agerstrand Corporation, Muskegon, Mich. Facilities to give fast and thorough Tool and Machine Engineering service, Electroplating, Heat treatment of steels, machining facilities and a complete up-to-date inspection department, are among the topics discussed. **658-D**

A UNIVERSAL TAPPING MACHINE that handles a wide range of tapping jobs is the Procunier Tapper. Bulletin 112, by Procunier Safety Chuck Co., 12-14 S. Clinton St., Chicago, Ill., gives full details on such important features as capacity range, large working table surface, automatic forced cutting lubricant and a conveniently located light for no-glare illumination. **623-D**

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"A BIG VISE FOR THE BIG JOBS"—says Ross about Rousselle Victory Vises in Bulletin 643 . . . and then goes on with complete details. One of the greatest advantages claimed for the vise is the tremendous saving in set-up time With complete graduations around the entire dial on the broad, plainly visible swivel base dial, the operator can quickly, easily and accurately set the vise at any degree. The Bulletin, available from David J. Ross Co., Benton Harbor, Mich., also covers Rousselle punch presses and adjustable spacers. **160-D**

"MILWAUKEE ARBORS" prepared for the ready selection of proper sizes and types of arbors for your milling machines, contains 10 helpful suggestions on how to prolong arbor life, maintain precision and trueness, detect distortion and springing, and secure maximum milling efficiency. In addition to a very complete list of standard arbors for both the new and old models of milling machines, it contains detailed specifications, descriptions and prices of collets, adapters and centering plugs for this same equipment. Catalog 42D is available from Kearney & Trecker Corp., Dept. J, Milwaukee, Wis. **592-D**

AN INTRODUCTION TO THE AGERSTRAND CORPORATION and their extensive engineering and manufacturing services is available in booklet form from the Agerstrand Corporation, Muskegon, Mich. Facilities to give fast and thorough Tool and Machine Engineering service, Electroplating, Heat treatment of steels, machining facilities and a complete up-to-date inspection department, are among the topics discussed. **658-D**

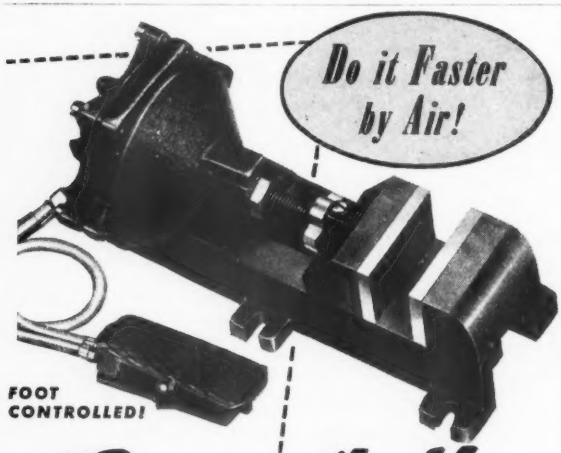
A UNIVERSAL TAPPING MACHINE that handles a wide range of tapping jobs is the Procunier Tapper. Bulletin 112, by Procunier Safety Chuck Co., 12-14 S. Clinton St., Chicago, Ill., gives full details on such important features as capacity range, large working table surface, automatic forced cutting lubricant and a conveniently located light for no-glare illumination. **623-D**

STOP DUST WITH DUSTKOP—is the subject and title of a bulletin by Aget-Detroit Co., Ann Arbor, Mich. The Dustkop, it is claimed, arrests dust at its source—tool, surface, internal, bench and laboratory grinders—before it can do costly damage to equipment, spoil precision work and impair the usefulness of valuable operators. Read all about this compact unit in Bulletin A-75. **577-D**

FOR BUYERS OF INDUSTRIAL EQUIPMENT AND SUPPLIES—Strong, Carlisle and Hammond Co., Dept. TJ, Cleveland, Ohio, has compiled complete factual data—arranged in the most practical and convenient reference form—as to the physical characteristics and use of Mac-it screws, list prices, shipping weights, together with pertinent engineering information. This is offered in Catalog No. 43 which also contains many informative illustrations. Send for your copy. **659-D**

MOTOR TOOL LIVE CENTERS—differ from tail stock stationary centers in that they rotate with the work. In addition, the spindle runs in a bath of oil—sealed in—reducing friction to a minimum. These and other exclusive features plus dimension tables and illustrations make up the bulletin released by Motor Tool Mfg. Co., 7779 Cortland Ave., Detroit, Mich. **124-D**

GAGES AND SMALL TOOLS—The encyclopedic information contained in the spiral bound catalog by Pipe Machinery Co., Cleveland, Ohio, makes it almost a handbook for the tool and die shop man. Design characteristics, dimensions, descriptions and tolerances of gages and tools are given. Of particular interest are the various sections devoted to thread terminology. Many conversion tables and dimension tables are included. A valuable book to have on hand for ready reference. **660-D**



SPEEDY AIR VISE

GRIPPING FORCE 15 TIMES AIR LINE PRESSURE

• Speedy Air Vise helps workers get out more and better work—in less time! Foot control valve opens and shuts vise instantly, leaving *both* hands free to produce. Operates from air line or individual compressor, exerting a grip of 15 times air line pressure. Jaw opens up to 3 inches, easily fitted to hold castings, parts, jigs. etc. Speeds up every drilling, light milling, tapping and assembly operation. Compact, sturdy, trouble-free, low in cost! ••••• *Speedy Air Vise, complete with Foot Control Valve, Air Hose and Fittings, only* $24

Prompt Delivery from Your Supplier or Write Direct.

W. R. BROWN CORPORATION
5714 Armitage Avenue • Chicago 39, Ill.

AIR REGULATORS • AIR FILTERS • AIR GUNS • PORTABLE COMPRESSORS

BURKE MILLING MACHINES—built with an accuracy that enables them to be used as jig borers, will perform any work within their capacity. How these machines operate and their specifications are all contained in a new bulletin issued by Burke Machine Tool Co., 301 E. 16th St., Conneaut, O. **661-D**

THE INSIDE STORY OF LIONITE ABRASIVE GRAINS—is compactly and pictorially related by the General Abrasive Co., Inc., Niagara Falls, N. Y., in their booklet "Lionite, King of Abrasives". Also discussed are such subjects as metal polishing and types of grinding wheel grains. **662-D**

HELPFUL DATA ON HOW TO FABRICATE ENDURO STAINLESS STEEL—is offered by Republic Steel Corp., Cleveland, Ohio. This modern metal is said to resist rust, corrosion and high temperatures. It has remarkable strength. Such operations as shearing, blanking and drawing; spinning and forming, rolling of molding sec-

(Cont'd on P. 150)

MOSQUITO BOMBERS

OF THE PRODUCTION LINE

VERNON Vertical Mills and Jig Borers are lightning fast in operation—as deadly as the Fortress, and built to do a superb job at substantially great savings in original cost. Truly —the mosquito bomber of the production line!

FEATURES . . . 8 spindle speeds, 4 belt changes · ultra precision, pre-loaded spindle ball bearings · spindle nose carburized, hardened and ground · spindle and internal taper ground for perfect concentricity · split thousandth table movements with measuring rods and dial indicators (if desired) · micrometer depth stop on quill · two quill feeds · headstock bore and quill honed for perfect fit · tapered gibs throughout.

Write for our bulletin —more features, full description, no cost.

VERNON VERTICAL MILL AND JIG BORER

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST. VERNON LOS ANGELES CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

(Continued from Page 148)

tions; press or brake forming; machining, forging, soldering, welding and silver brazing; riveting; grinding, polishing and buffing are all treated in detail with factual information and graphic illustrations. Charts giving approximate blank diameters for cylindrical shells, properties of Enduro, comparative physical and mechanical properties of ferrous and non-ferrous metals are included. **27-D**

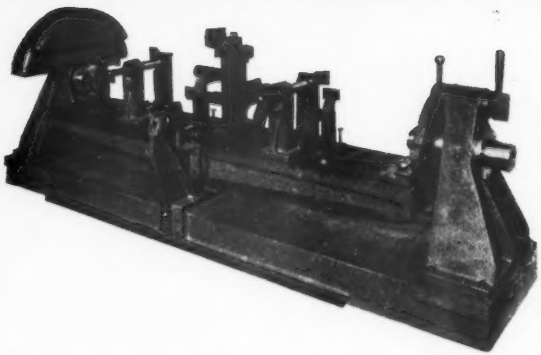
"FOSTORIA LOCALIZED FILTERING" — The widespread adoption of localized filtering for precision grinding and honing work assures each wheel sludge-free coolant; and each operation may be supplied with the quality and type of coolant solution it needs for best results. The method and pertinent data on localized filtering units are all contained in this new Catalog available from Fostoria Pressed Steel Corp., Fostoria, Ohio. **663-D**

FACILITIES FOR THE ENGINEERING AND SETTING UP OF JIGS AND FIXTURES in pilot and production lines are featured and illustrated in the new standard and special tool catalog issued by the Galter Mfg. Co., 709 W. Lake Street, Chicago, Ill. **664-D**

POINTS IN VULCAN FURNACE DESIGN AND CONSTRUCTION—assuring uniform heating, accurate control and a faster cycle, are highlighted in an illustrated booklet by Vulcan Corp., Eighth & Cherry Sts., Philadelphia, Pa. Typical installations of Vulcan furnaces, with a brief explanatory note on each, are depicted. **665-D**

A COMPLETE LINE OF PERMANENTLY ACCURATE gaging and measuring Torque Wrenches is offered by P. A. Sturtevant Co., Dept. J, Addison, Ill., in their broadsides. An interesting booklet "Selecting Production Control Tools" is also available. **479-D**

We Sell Precision . .



★ Dies, Jigs, Fixtures, Special Machinery and Designing.

Hardened and Ground Parts to Order.

MASTER MACHINE & TOOL COMPANY

925 WEST NORTH AVENUE, CHICAGO, ILL.

CARBIDE CUTTERS — descriptions and specifications for all types of cutters — staggered tooth milling cutters, half side milling cutters and mills (standard, high speed, heavy duty bore face, adjustable face and step)—are all helpful ordering aids for the busy shopman. The catalog is published by Machinery Mfg. Co., 1915 E. 51st St., Los Angeles, Cal. **666-D**

CF FURNACES—How accuracy and speed in heat treating capacity loads in tool rooms and production lines have made it possible for users of Despatch furnaces to establish many new performance records is explained in Bulletin 83. Cross sectional views and illustrated typical uses are included. Despatch Oven Co., Minneapolis, Minn. **584-D**

"BACKGROUNDS" — an impressive Pratt & Whitney publication — contains worthwhile news of current progress in the use of P&W tools, gages and "machines that build machines." *(Cont'd on P. 152)*

The TESTMASTER

REG. U. S. PAT. OFF.

UNIVERSAL

DIAL INDICATOR

with the NEW

INDEX POINT

that locks in place and sets positively

Serrations mesh positively. Interchangeable point locks on pivot. Low friction bearings.

Crown gear reduces friction and inertia — greater accuracy.

Illustrations are actual size

You get more quality features in this new FEDERAL Universal Test Indicator.

The Testmaster is chock full of features that you will appreciate more and more as you use it.

It is accurate. Its point swivels positively, works in either direction and won't come out unless you want it to. The universal clamp and dovetail slides make it handy. Its quality is worth more than the price. Write for circular.

For lining up and testing machine work the Testmaster is exceptional.

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PRECISION MEASURING INSTRUMENTS

Chicago · Cleveland · Detroit · Dallas · Hartford · Houston · Indianapolis · Los Angeles · Memphis · Milwaukee
Minneapolis · Montreal · New York · Philadelphia · Pittsburgh · Rochester · San Francisco · St. Louis · Toronto · Windsor

(Continued from Page 150)

Accelerated technical progress in wartime always influences conditions in the post-war world that follows. Included in Backgrounds (Vol III. No. I) are two articles: "The Electronic—Key to the Future?" giving a general picture on the developments and changes to be wrought by electronic magic, and "Tales of a Trouble Shooter" written in an entertaining story-book style, both of which prove informative and amusing at the same time. Pratt & Whitney Corp., West Hartford, Conn. **430-D**

"THE HANDIEST RACK IN THE SHOP" is a remarkable capacity and space-saving item claims Wm. S. Yohe Supply Co., 587 Gibbs Ave., N. E., Canton 4, Ohio, in their new folder. Dimensions and capacity of the "Handiest Racks" plus letters from users are given. **667-D**

THE FABRICATION & SURFACE TREATMENT OF STAINLESS STEEL—is the subject of a Field Service-special report offered by Oakite Products Inc., 22 Thames St., New York, N. Y. Detailed explanations of operations such as machining, grinding, drawing and forming, degreasing and cleaning before welding, and annealing are given. **121-D**

HILL-CLARKE NOW BRINGS SUPER GRINDING—to the fore in their attractive and profusely illustrated cylindrical grinder catalog. The concise definitions of Super Grinding & Micro-Finish plus detailed descriptions and specifications of their complete line of grinders will prove informative to all tool room and die shop men interested in super grinding, micro-finish and precision. Hill-Clarke Machinery Co., 646 Washington Blvd., Chicago, Ill. **39-D**

The Mark of Quality

SWANSON
TOOL AND MACHINE CORPORATION, ERIE, PA.

Since 1919

SCRAPED SURFACE PLATES

MADE IN 24 DIFFERENT SIZES UP TO 36" x 60"

- Properly designed.
- Made from proven material, properly stabilized to prevent distortion and to outwear ordinary iron.
- Made to the most exacting standards that insure the highest degree of accuracy obtainable in any plate.
- More bearing per square inch for less cost.

"You Can't Buy a Better Surface Plate"

SWANSON TOOL & MACHINE CORPORATION

818 EAST EIGHTH STREET • ERIE, PENNSYLVANIA

MANY TIME AND PRODUCTION SHORT CUTS—in deburring, finishing and polishing are described and illustrated in a comprehensive catalog on rubber cushioned abrasive products issued by Brightboy Industrial Div., Weldon Roberts Rubber Co., Newark 7, N. J. A table of machine speeds covering the use of Brightboy wheels; descriptions of wheels, rods, sticks, tablets and special shapes used in manual operation; and the scope and purpose of two new Brightboy textures — Fine-Tex for work on softer metals and for producing special finishes; Tuff-Tex for rougher finishing and work on hard metals—are all included. **668-D**

AFTER EXTENSIVE RESEARCH—certain extremely hard natural granite has been found by The Herman Stone Co., Dayton 2, Ohio, to be ideal for surface plates. In leaflet FU-2731, available on request, they tell how the almost diamond-hard surface of their Pre-

(Cont'd on P. 154)

OVER 20 YEARS OLD

. . . accurate as a new tool

With scraping of the ways, minor part replacements, and an EX-CELL-O PRECISION SPINDLE, this grinder was brought back to new life at a minimum of cost.

EX-CELL-O CORPORATION • DETROIT

Send for Catalog S-537 for list of grinding machines on which Ex-Cell-O Precision Spindles are used as standard original or replacement equipment.

XLO

EX-CELL-O *for* PRECISION

EX-CELL-O *Precision* GRINDING SPINDLES

(Continued from Page 152)

cision Granite Plate is practically indestructible under normal conditions, assuring many years of accurate service. It also points out that since their plates are made of natural granite, originally molten and seasoned over a period of millions of years, no internal strains are present to cause warpage. **669-D**

THE SPRINGFIELD PRECISION TOOLROOM LATHE—features a deep, well-ribbed bed made from high test nickel chrome gray iron which gives greater wear resistance, freedom from scoring and internal strains—factors all resulting in greater accuracy throughout the life of the lathe. Bulletin 162 tells more about the why and how of Springfield's accurate production. Available from The Springfield Machine Tool Co., Springfield, Ohio. **647-D**

"SCORES OF APPLICATIONS PROVE THE VERSATILITY OF UNIVERSAL COLLET CHUCKS" say Universal Engineering Co., Frankenmuth, Mich., in a new booklet on that subject. A few of the applications with brief explanatory notes are depicted. Many diagrams show the unique construction features incorporated in Universal Collet Chucks. **276-D**

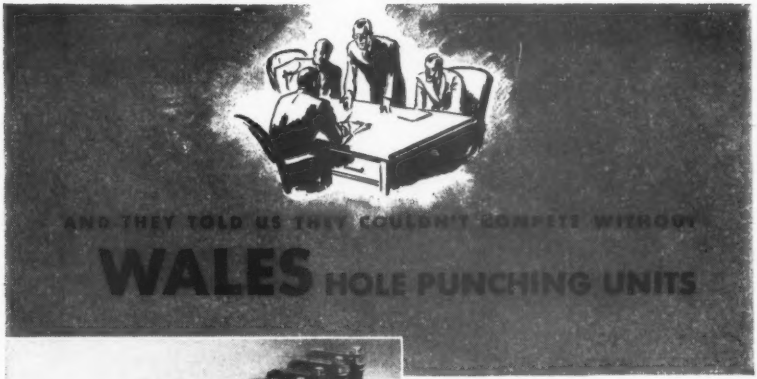
CHICAGO WHEEL'S SERVICE TO INDUSTRY—The mounted wheels for industrial application manufactured by Chicago Wheel & Mfg. Co. perform countless operations formerly done by hand at a big saving in time, material and money. The company's claim that "there is a proper type Chicago Mounted Wheel for every job and every equipment" is substantiated in their new booklet available to the Industry. Direct your request to the company at 1101 W. Monroe St., Dept. TD, Chicago, Ill. **642-D**

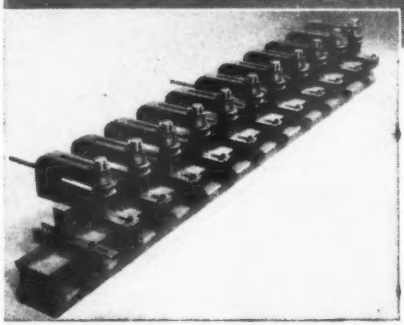
Precision Molds Broaden the Field for Plastics
Crystal cases of Signal Corps field radios; relay boxes for PT-boat ignitions; screw-parts for weight-saving assemblies — intricate shapes quickly molded of plastic instead of painfully machined from metal — these are a few of the economies in critical materials and time which have been made possible because of Precision Molds.
Almost daily, inquiries come to us from troubled manufacturers asking whether plastics could be molded accurately to meet specifications. To those who send sample items, or who furnish details, we reply almost daily that a comparable job is being done now!
Why not let us co-operate in the solution of your problems as they relate to time, costs, materials and specifications?
GO
PRECISION
AUTHENTICATORS
NO-GO
ELECTRIX
Corporation
Peace-time engineers of soft-rubber connectors for electrically-operated equipment
150 MIDDLE ST., PAWTUCKET, R. I.

"YEARS-AHEAD DESIGN"—tools for the production lines of war is presented in a 50-page catalog issued by the Aero Tool Co., 237 West Olive St., Burbank, Calif. This 1942-43 catalog of cup-forged, comparameter inspected, microglass polished precision aircraft tools was developed in cooperation with leading aircraft manufacturers. Fundamental requirements of every tool herein presented are accuracy, to reduce reworks and rejections and applicability, to assure the right tool for the right job. **174-D**

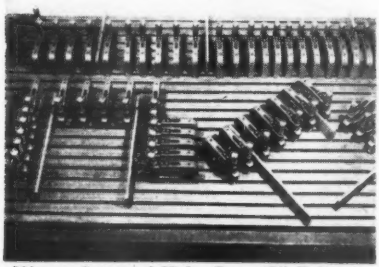
"MATCH THE MACHINE TO THE JOB"—an Atlas idea plus modern Atlas construction features and complete specifications are presented in attractive Catalog No. M43 . . . all information on Atlas Milling Machines in one handy

(Cont'd on P. 156)

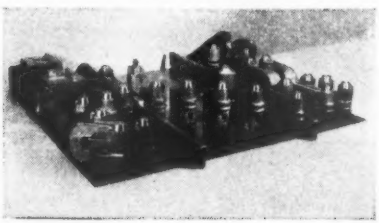




Above: Showing staggered pattern set-up for punching holes in sheets on press brakes with Wales Type "B" Hole Punching Units. Front to back adjustment is made possible by Wales Adjustable Adapter.



Above: Set-up of Wales Type "B" Units on a T-slotted plate used in stamping presses. Below: Template set-up of Wales Type "B" Units for stamping presses. The same units may be used and reused interchangeably on all 3 set-ups shown above.



THIS ACTUALLY HAPPENED—Recently 3 men walked into our offices and asked to know more about Wales Hole Punching Units.

THE REASON—For years they were the leading manufacturers of their particular metal products BUT their leadership was threatened by the competition of a newcomer who was manufacturing the same products at a lower price. By checking, our visitors discovered their competitor was using Wales Hole Punching Units to produce the products cheaper. That is why they stopped in to see us.

THE RESULT—We received an order to supply our visitors with Wales Hole Punching Units after we showed them the following exclusive time-saving, money-saving features of Wales Units:—

1. Usual time-consuming adjustments required to line up punches and dies of conventional set-ups are eliminated.
2. Punch and die held in perfect alignment by holder.
3. Each unit is independent and self-contained with punch, die, stripping assembly and holder.
4. Setting and resetting straight line, staggered or scattered patterns only require placing each unit in exact location with master template as guide.
5. Same group of units may be used interchangeably on press brake rails, and T-slotted plates and templates in stamping presses.
6. Nothing is attached to press ram.
7. Each individual unit may be instantly removed or reset according to pattern changes without disturbing rest of set-up.
8. Interchangeable punches and dies provide for punching various sizes and shapes with same holder.
9. Die setting time and press "down time" are cut from hours to minutes.
10. Same units may be used and reused in active patterns, thus eliminating "dead storage."

There's Always Something New in the Wales Line

to help you solve your hole punching problems.

Keep posted by writing for Bulletin B.

◆

WALES-STRIPPIT CORP.

355 Payne Avenue North Tonawanda, N. Y.

George F. Wales, President

Specialists in Punching and Notching Equipment

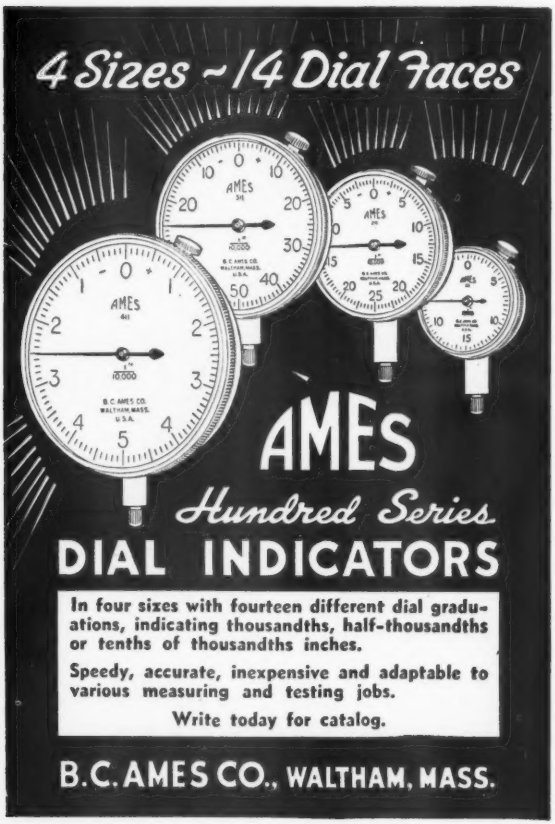
(Continued from Page 154)

book. Atlas Press Co., 1012 N. Pitcher St., Kalamazoo, Mich., will send a copy. **537-D**

USE C-F POSITIONERS FOR FASTER, BETTER, MORE ECONOMICAL WELDING is the theme of Bulletin WP-22 by Cullen-Friestedt Co., 1316 S. Kilbourn Ave., Chicago, Ill. Features of the C-F Positioner, which is versatile in movement and provides complete maneuverability of cumbersome weldments with a minumum of handling are explained completely with the aid of detailed line drawings. The vivid illustrations—exciting as a double play enacted before the eyes—show the Positioner in action. Concise captions enlarge upon the advantages of the Positioner. Interesting reading and available to all who make such requests on company letterhead. **670-D**

SANFORD SAYS "Here It Is Toolmakers! You've been waiting for this High Speed Precision Bench Surface Grinder" and tells why in Bulletin C. Attractive illustrations show the grinder in action, various assemblies and parts which may be ground. Manufacturer, Sanford Mfg. Co., 1279 Springfield Ave., Irvington 11, N. J. **128-D**

VERSATILITY PLUS—With the variety of attachments available for the Greenfield No. 4 Tool & Cutter Grinder, there is hardly a grinding operation that cannot be handled within its capacity. It can be furnished either as a plain cutter and reamer grinder or as a universal type with any or all attachments. A booklet has been issued which discusses the grinder's many features and uses, and lists attachments and specifications. For your copy of Bulletin 2, write Production Machine Co., Dept. TJ, Greenfield, Mass. **671-D**


4 Sizes ~ 14 Dial Faces
AMES
Hundred Series
DIAL INDICATORS
In four sizes with fourteen different dial graduations, indicating thousandths, half-thousandths or tenths of thousandths inches.
Speedy, accurate, inexpensive and adaptable to various measuring and testing jobs.
Write today for catalog.
B.C. AMES CO., WALTHAM, MASS.

TURN THE DIAMOND FREQUENTLY in order to ensure sharp cutting points at all times, longer wheel life and greater wheel efficiency advises a 12-page booklet entitled "Diamonds In Industry", issued by J. K. Smit & Sons, Inc., 163 Chambers St., N. Y., N. Y. To give utmost satisfaction the diamond must be treated as a precision tool, and certain rules are presented to help the operator secure not only longer diamond life, but also better grinding. **48-D**

IDEALLY SUITED FOR processing magnesium is the orifice type Hydro-Whirl Dust Collector discussed in a 4-page folder by Peters-Dalton, Inc., Dept. J, 628 E. Forest Ave., Detroit 1, Mich. Engineered to meet your particular requirements—sizes 2,000 to 100,000 cfm—it is recommended for all forms of metal dust (iron, aluminum, magnesium) created from grinding, buffing, polishing, or sanding operations, as well as for various types of lint. After passing through the unit, the

(Cont'd on P. 158)

SHIFT YOUR
PRODUCTION
INTO HIGH...
FORWARD
REVERSE
with TECO Cemented Carbide!
Hard-pressed to meet production schedules? Take full advantage of the higher-speed operation made possible by TECO Cemented Carbide in your turning, boring, facing and other machining work.
TECO Cemented Carbide not only cuts at higher speeds, but stays on the job longer. It holds cutting edges and maintains accurate tolerances for longer runs, producing more pieces between grinds. Hundreds of job records prove it!
This extra capacity is due to the rigidly controlled hardness, density and uniformity of TECO Cemented Carbide. Available in tools and blanks —in styles, sizes and grades for practically every machining need. Write for detailed catalog.
TUNGSTEN ELECTRIC CORPORATION
574 39th Street • Union City, N. J.
Branch Office: 2906 Euclid Ave., Cleveland, Ohio
Representative:
Architects and Builders Bldg., Indianapolis, Ind.
Pioneers in Tungsten Carbides
for over a Quarter Century
TECO
CEMENTED CARBIDE

(Continued from Page 156)

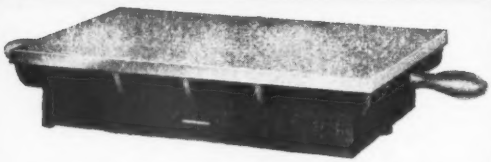
air is conditioned and returned to the room without appreciable heat loss. **672-D**

"THE STRANGE CASE OF THE MURDERED END MILL"—this entertaining and instructive booklet explains in simple terms how to get longer life from End Mills. The booklet explains that "end mill mortality is not the result of accidents that merely happen; it is more often a case of murder in the First Degree." It points out by the cause and correction explanatory method and free hand drawings how End Mill "murder" is committed and how it can be prevented. Other helpful data includes a speed chart and more about this company's Engineering Service. The brochure is offered by Melin Mills, 2228 Bellevue Ave., Detroit 7, Mich., to every milling hand and is particularly valuable for new men. **109-D**

DIE SETS AND DIE MAKERS' SUPPLIES—by Detroit Die Set Corp.—are brought together in one catalog, complete with photographs and blueprint drawings, dimension tables, general instructions for ordering and list prices. **674-D**

BLANCHARD SURFACE GRINDERS—the heavy and accurate machine tools that not only, it is claimed, grind rapidly such flat work as is ordinarily done on a surface grinder, but are widely used in machining flat surfaces on castings and forgings directly from the rough to finish size in one operation—are discussed in General Catalog 232. The information includes a brief description, illustration and complete specifications for each machine and attachment discussed. The catalog is available from Blanchard Machine Co., 64 State St., Cambridge, Mass. **604-D**

A TRUE SURFACE



...CHALLENGE SURFACE PLATES provide a TRUE surface for tool making, inspection and testing. Built to retain their accurate plane surface that will not sag under load. Either hand-scraped or precision ground. Made in a wide range of sizes.

- **DUPLEX BENCH BLOCKS:** (Precision Ground) double utility working surfaces—top and bottom. Internal ribbing for strength. Practical base for small fixtures and tools. Surface area 10x14x2⅜ inches.
- **LAPPING PLATES:** (Semi-steel). Specially heat-treated, carefully machined and designed for lapping of delicate joints. Arc-welded stand optional. Closely spaced lock-leveling screws. Wide range of sizes.
- **LAYOUT SURFACE PLATES:** Semi-steel (Planer Finish). A recommended true surface for layout, inspection or assembly. Arc-welded stand optional. Closely spaced lock-leveling screws. Wide range of sizes.

WRITE FOR DETAILED INFORMATION. 451

THE CHALLENGE MACHINERY CO.

Main Office and Factory: GRAND HAVEN, MICH. 1893 50TH ANNIVERSARY 1943 Eastern Sales Office: 50 Church St., NEW YORK

EASIER TO HANDLE than cast iron plates because they are lighter, are the new Truplane white structural glass surface plates illustrated in a leaflet issued by the Die Supply Co. Dept. T, 4751 Hough Ave., Cleveland, O. They do not warp or twist and are unaffected by temperature changes. Sizes are available in 14" x 18", 16" x 20" and 20" x 24". **550-D**

ESPECIALLY ADAPTABLE to production lines, individually operated machine tools and built to NEMA specifications meeting the requirements of the general manufacturer, are Lima Electric Motors, described and illustrated in an interesting catalog issued by The Lima Electric Motor Co., 862 Findley Rd., Lima, O. Gearshift drives for machine tools and production equipment, Pedestal Grinders and Magnetic Polishing Lathes are also discussed. The latter are now manufactured in both Pedestal and Bench types for rapid handling of steel or ferrous metal parts in polishing, burring or lapping operations. **571-D**

(Con't on P. 160)

New KRW HYDRAULIC PRESS BULLETIN *Now Ready!*

Typical pages from the new KRW Hydraulic Arbor Press Bulletin.

Not only a complete catalog of the full KRW Arbor Press line, but an "idea book" for production men. Describes many new attachments, fixtures and special presses developed by KRW to speed war production. Illustrates the new 60-ton KRW Hydraulic Press, the 25, 50 and 75-ton sizes, and KRW Bench Type Arbor Presses in 1/2, 1 and 3-ton capacities. Write for your copy today!

K. R. WILSON
10 LOCK ST., BUFFALO 2, N. Y.

(Continued from Page 158)

INSTRUCTIONS AND PARTS LIST FOR Atlas 7-Inch Metal Shaper is presented in Catalog No. 7B and 7AB issued by the Atlas Press Co., 812 N. Pitcher St., Kalamazoo, Mich. This catalog is full of important information including diagrams and an interesting lubrication chart for No. 7B and 7AB shapers. **537-D**

"OPEN SIDE" HYDRAULIC SURFACE GRINDERS—manufactured by The Hill Acme Co., 6408 Breakwater Ave., Cleveland, O., have been responsible for the unusual production increases reported by their users. This is attributed to the fact that Hill Grinders are designed and built for continuous heavy duty grinding. A circular is available on request. **97-D**

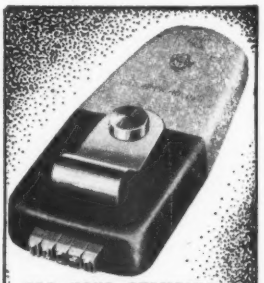
HAVING THE APPEARANCE OF A DOMESTIC IRON, the "Nedco" Handi-Sander has hundreds of uses as given in a leaflet available from The Lintern Corp., Nedco Div., 24 Lincoln Ave., Berea, O. It is smooth working, fast cutting and vibrationless. It allows a back and forth motion—without sidewise movement—producing a handsome satinlike finish. Even inexperienced women workers can operate it throughout the shift without undue fatigue. **370-D**

A COMPLETE SYSTEM FOR PRODUCING WASHERS, thus eliminating process engineering, tool designing, tool making and tool tryout, is offered by Hovis Screwlock Co., 8100 E. Nine Mile Rd., Van Dyke, Mich., in an illustrated folder Detail of the plan, price list and a sectional line drawing showing the construction of the Movis Universal Master Washer Die are included. **135-D**

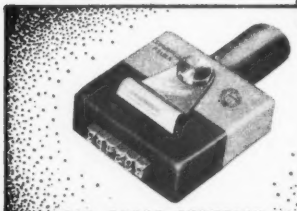
STAMPING MULTIPLE CHARACTERS

with Matthews
***Champion* HOLDER**

Made for hand stamping or press use... Matthews 'Champion' Holder can be used for 90% of all heavy or medium duty marking applications. Type changing is amazingly fast... marking is clean cut and in alignment. Write for Catalog 146-A for full particulars.



FOR HAND STAMPING



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Cleveland Detroit Hartford Birmingham

LEMPCO-EVANS INDUSTRIAL REAMERS — unlike ordinary reamers, consist of the body and shank in one piece, and three replaceable "dual-spiral" cutting blades. These and other exclusive features, maintain Lempco Products, Inc., 5713 Dunham Rd., Bedford, Ohio, make it possible to obtain 100 times more service with L-E reamers. Full details in Folder 643. Send for your copy. **540-D**

JESSOP MUSTANG HIGH SPEED STEEL—a tungsten-molybdenum steel of excellent cutting abilities which will deliver maximum hardness and wear resistance for tools that get hotter in service than about 300° F is offered by Jessop Steel Co., Washington, Pa., in new Bulletin 143. Jessop's usual style of giving the reader a complete picture—from typical applications and analysis through such processes as forging, annealing, hardening, quenching and tempering—is followed. A copy is available on request. **259-D**

WE cannot offer you the services of Brahma, the Hindu God whose universal power is symbolized by four heads and many hands.

But, here at McKinney's is available the combined service of several score of competent engineers with hundreds of hands to quickly translate their proved, specialized knowledge into designs for close tolerance production tools.

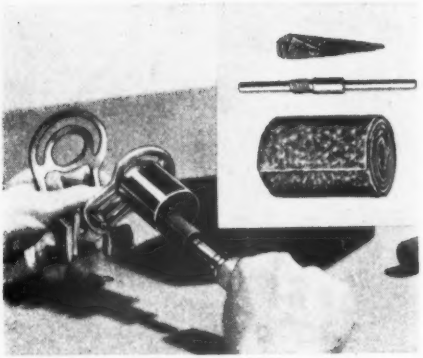
It is a service valued and used repeatedly by manufacturers from coast to coast — many of whom have been signally honored for outstanding production of vital war materiel.

We are completely equipped in our large modern plant, manned by hundreds of skilled craftsmen, to build the tools designated by these designs — and in some instances we also contract to produce parts, assemblies or complete products.

Write, phone or wire us. Within a few hours after receiving your request a McKinney engineer will call to discuss any work you may have under consideration — for immediate or future requirements.

McKINNEY TOOL & MFG. CO.
CLEVELAND
DESIGNERS and BUILDERS of PRECISION TOOLING
Since 1920
1673 ARABELLA ROAD
Tools·Dies·Jigs·Fixtures·Special Machinery

Flexible Abrasive Prevents Work Distortion



FLEXIBLE abrasive wheels and Micro Points, made from tough wear resisting abrasive material in all grits from the coarsest to the finest for any job, have been developed by the Flex-Abrasive Co. Designed for precision work where flexibility is required, they can easily deburr exterior edges and finish irregular surfaces, ordinarily hard to get at—such as holes, openings and corners. They are made in many different types and sizes for use on hard alloy steels, wood, rubber, resin and plastics.

Their advanced patented construction has created a superior flexible abrasive wheel and point placing fresh abrasive surfaces constantly in contact with the work permitting full use of the roll or point down to its final layers without unraveling. Mandrels are of tapered thread construction which firmly locks the abrasive wheel or point to the shaft by its rotary motion. Inexperienced operators can instantly remove or replace wheels or points from the mandrels without the use of tools, nuts, split shafts or grommets. According to the manufacturer, Flex-Abrasive Wheels and Micro-points are revolutionizing abrasive procedure throughout the war plants of the nation.

For more complete information address The Flex-Abrasive Co., Div. T, 100 N. LaSalle St., Chicago Ill. 675-D

Use Them Over and Over

DE-STA-CO ARBOR SPACERS

Measured by the number of times they can be used, De-Sta-Co Spacers are the lowest in cost of any spacers you can buy. Made of metal, they are not affected by oil or heat. Use these spacers for quick set-up of milling machine cutters and wherever low cost, accurate spacing is required.

Stock sizes .001″ to .125″ thick. Specials, any length, cut from bar stock, ground to decimal.

TRIAL ASSORTMENT—enough for average use on one machine sent for $1.00. Give arbor size. *Size and price list sent FREE!*

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Established Over 25 Years
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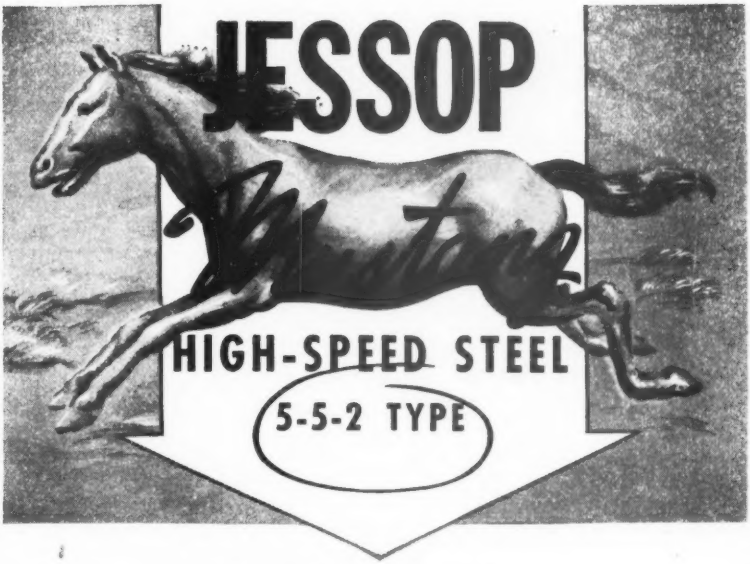

- Tungsten-Molybdenum Tool Steel
- Excellent cutting abilities
- Maximum hardness and wear resistance
- Greater production between grinds

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Boring Tools	Drills	Reamers
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Our representatives will be glad to advise you on availability and application of Mustang for your requirements.

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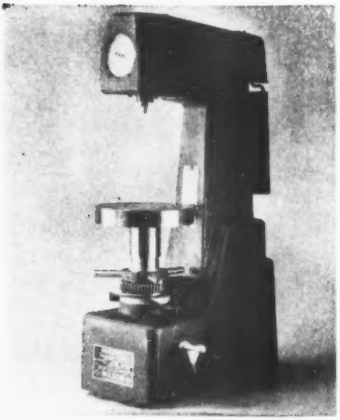

Rockwell and Rockwell Superficial Hardness Testers

A TWENTY-two-year program of engineering development and operational simplification is embodied in the current "Rockwell" Hardness Testers. To the original "Rockwell" Tester introduced in 1921 the "Rockwell Superficial" Tester, for testing the hardness of thin metals, was added some ten years later.

Both instruments now include new features and developments which were first incorporated in one thousand extensively used and carefully watched machines. By those whose job it is to operate "Rockwell" Testers day in and day out these improvements have been enthusiastically received.

Setting the dial to zero is no longer done directly on the gage but by actuating a knurled ring under the capstan nut, which is connected to the gage by a bronze cable and pulleys housed inside the iron pedestal.

The dash pot which insures accuracy and consistency by governing rate of load application is located inside the pedestal and for adjustment is readily accessible through doors. The dash pot has a variable speed adjustment to adapt the rate of load application to the kind of material being tested.

The gage dial has a supplemental scale which permits zero setting during instead of before the period of major load application. This saves time in "high production" inspection.

Fully detailed and illustrated literature may be had from Wilson Mechanical Instrument Co., Inc., 381 Concord Ave., N. Y., N. Y. 676-D

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● Widely used throughout industry and trade schools, "Tool Steel Simplified" meets the urgent need for a complete, up-to-date text for training new men, "refreshing" older men, or trouble shooting in the tool room. Tells in easy shop language how to select tool steel, how to make tools, how to improve tool performance. It is available *at cost*, $1.00 per copy, to tool steel users in the U. S. A.

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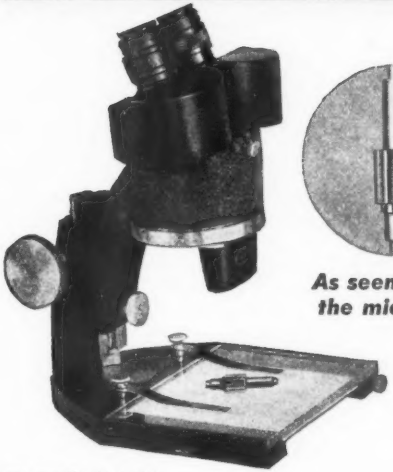
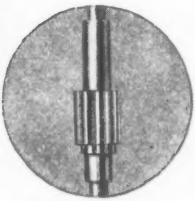
Simplifies Inspection Work





As seen through the microscope

Price $143.50

The Spencer Binocular Microscope extends and improves the quality and precision of your inspection work. It simplifies the examination of raw and finished materials for surface flaws and irregularities.

CONSIDER THESE OUTSTANDING ADVANTAGES

- Use of both eyes without strain or fatigue.
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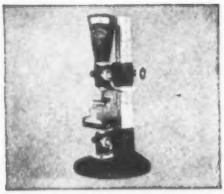
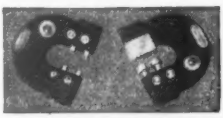


SCHERR COMPARITOL—for checking gage blocks, gages and work for size, accuracy and wear. $195.00



ATLANTIC ADJUSTABLE **LIMIT** SNAP GAGES—for accurate check-up, without having to depend on operator's skill. Sizes to 6".

MAGNI-RAY—a wide field illuminated magnifier for close inspection of work and operations. $18.50 List.

SPENCER BINOCULARS — for detecting surface finish, imperfections, etc., by means of 3-dimensional vision. $143.50.

WILDER PROJECTOR provides accurate measuring or comparison of objects by means of magnified shadow.

GEORGE SCHERR COMPANY, INC. 128-8 LAFAYETTE ST., NEW YORK, N. Y.

New Type Diamond Dressing Tool

A NEW type diamond dressing tool recently developed and announced by Wheel Trueing Tool Co. of Detroit, Mich., has established a record of production increases up to 500% and reductions in production cost of as much as 75%, it is claimed.

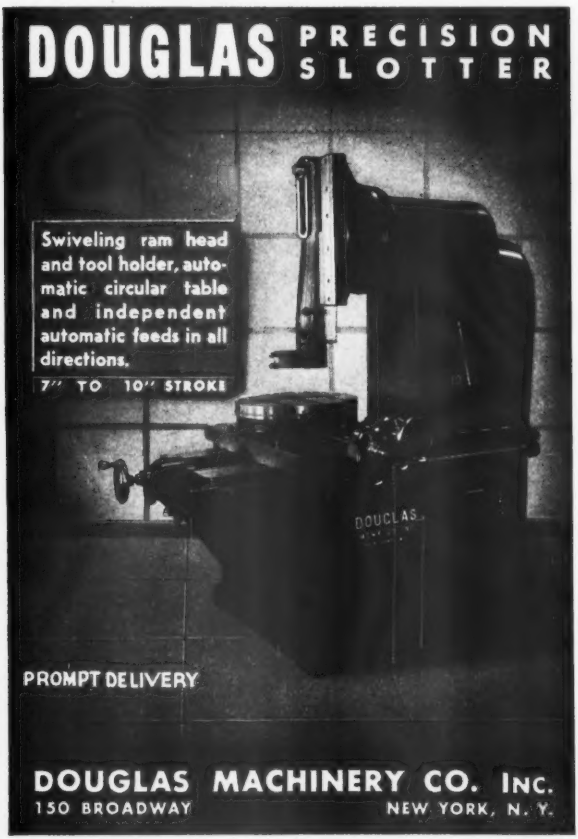
With this new tool, the hard characteristics of the uncut diamond may be utilized, yet it is of a shape that permits not only straight dressing, but angle, radial and multiple form dressing as well.

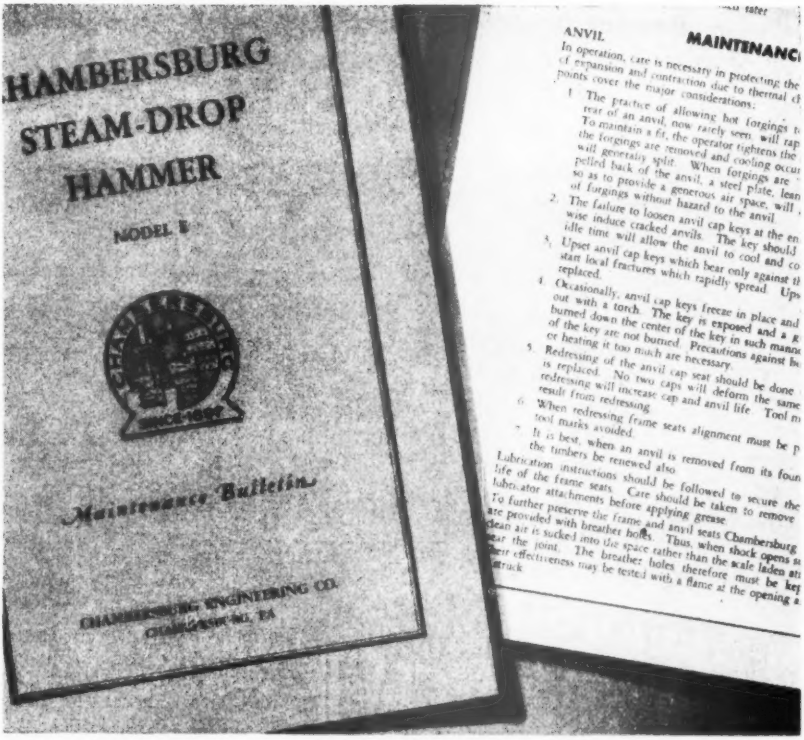
This tool produces exceptionally clean cuts; thus forms are obtained quickly and held longer. These cleaner cuts permit more work to be ground between dressings, greatly reducing machining time. Another advantage of this new type diamond tool is that it can be made and re-serviced on a production basis, assuring quicker deliveries.

Our article this month on hardenability rather than chemical analysis as a steel specification may give your purchasing and heat treating departments an idea or two.

Company records show that production on the dressing tool has increased from an original 8 units per machine per day to 80 units for the same period of time. It can be used for dressing the wheels that grind Whitworth, Buttress, Acme or any standard or special thread.

Full particulars may be obtained by writing Wheel Trueing Tool Co., 3200 W. Davison, Detroit, Mich. 522-D


DOUGLAS PRECISION SLOTTER
Swiveling ram head and tool holder, automatic circular table and independent automatic feeds in all directions.
7" TO 10" STROKE
PROMPT DELIVERY
DOUGLAS MACHINERY CO. INC.
150 BROADWAY
NEW YORK, N. Y.



Chambersburg 35,000 lb. Model "E" Steam Drop Hammer

GET THE MOST OUT OF YOUR HAMMERS

DROP FORGINGS are more essential today than ever before. Millions of forgings per year are needed for the aircraft program alone. Production of hammers at Chambersburg is at an all time high . . . Yet more are needed. Older hammers must therefore do more than ever . . . must last longer. There are many ways to get more out of your hammers . . . perhaps you can get some new ideas out of our Model "E" Steam Drop Hammer Maintenance Book . . . Write for a copy . . . even if your hammers are *not* Chambersburgs.

CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.

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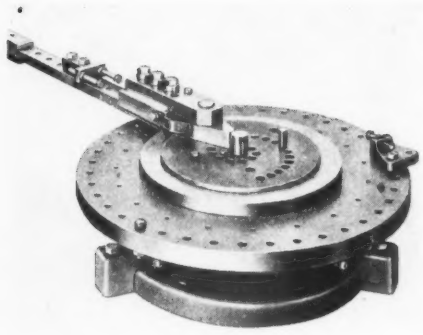
Bender for Aircraft and Machine Work



IN answer to the demand for a bender capable of forming greater diameters, O'Neil-Irwin Manufacturing Co.'s engineers have developed the Di-Acro Bender No. 3. Especially designed for aircraft and machine work, it will quickly and economically form or duplicate all types of tubing, channel, angle, I-shaped sections and round, square, flat or any other shaped solid or open cross section materials. Moldings or various other materials of partially opened or irregular outline can also frequently be formed to accuracies within production die tolerances.

The capacity of this unit is a ½" round cold rolled steel bar, formed cold to 1" radii or longer—greater capacity of more ductile materials in proportion.

Twelve convenient right or left hand operating positions for either bench or pedestal mountings are provided with the standard bender and any additional positions required are obtainable by virtue of design of this unit. Accuracy is guaranteed to a tolerance of .001" in all duplicated work.

The Di-Acro Bender No. 3 is so designed that it can be easily converted into a highly specialized bender capable of accurately forming all types of regular or irregular shaped materials.

Ask for Bulletin 19A when writing O'Neil-Irwin Manufacturing Co., 315 Eighth Ave., S., Minneapolis, Minn. 20-D

Everything you want

in this new, rugged, accurate

DURO 18-inch DRILL PRESS

HERE'S a new husky low-cost DURO drill press that can handle efficiently a wide range of drilling and tapping jobs—or be easily adapted for many specialized operations. It incorporates new exclusive features including special design which permits quick changing of belts, six-spline telescopic, self-aligning spindle that reduces play to a minimum. Production table has 14" x 18" machined surface. Efficient production foot feed available. Heavy base with 12" x 12" machined surface. Specifications include: ¾" capacity. No. 2 Morse Taper. 4 New Departure Ball Bearings. Speed range 425 to 2030 R.P.M. Spindle travel—5". Drills to center of 18" circle. Maximum distance from base to spindle—49". Maximum distance from table to spindle—19". Overall height—68". Weight (as illustrated) less motor, 350 lbs. Also available in bench model.

Send for New Complete DURO Catalog giving full specifications and prices.

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...6 N. Kildare Avenue, Chicago ...

Gentlemen: Please send me FREE copy of latest DURO Catalog giving full specifications on new DURO 18-inch Drill Press and other DURO Machine Tools.

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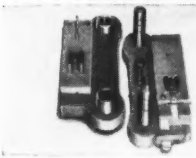
DURO TOOLS MACHINE TOOL DIVISION

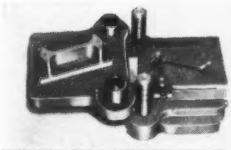
ALSO MAKERS OF DURO HAND TOOLS

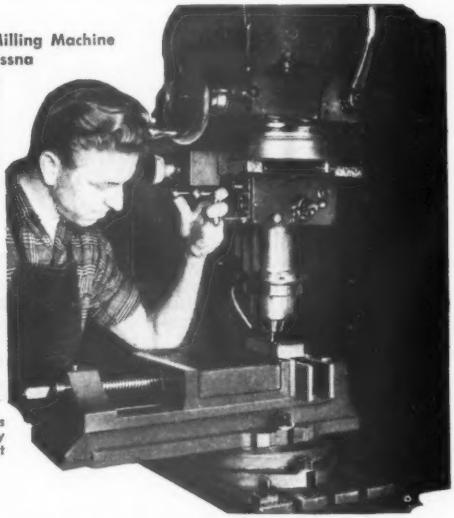
"One of the most Outstanding Machines I've ever seen"

JOHN W. RIX, *Mfg. Engineer*, Cessna Aircraft Co.

The Milwaukee Rotary Head Milling Machine "Under Fire" At Cessna







On tools like these no layout was required. All machining was done by working to "dial" graduations. Direct measurements were eliminated.

Proof That This Machine "Has what it takes"

Is Found in Mr. Rix's Statement:

"I consider the Milwaukee Rotary Head Milling Machine to be one of the most outstanding machines I've ever seen for tool room work. It paid for itself in the first few months of operation. We have repeatedly accomplished feats which I would not have believed possible if I had not seen them myself." *(signed)* JOHN W. RIX

Since purchasing their first Milwaukee Rotary Head Milling Machine, Cessna Aircraft has milled hundreds of complicated blanking dies of geometrical form. Furthermore, they milled the punches to fit these dies with .001" clearance in between without resorting to hand fitting of any kind.

This meant that the punches and dies were heat-treated at the same time. Then, after surface grinding, they were ready for mounting on the die set.

• • •

As a leader in your field you should have the complete story on the Milwaukee Rotary Head Milling Machine and its remarkable, low-cost performance. Write for Bulletin 1002A.

Rotary Head Milling Machine
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Kearney & Trecker
Products
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
Milwaukee Midgetmill
Milwaukee Speedmill

SHOP AIDS

In requesting copies of books, please address your request directly to the designated publisher.

WHEN IS 4" NOT 4"?—The 4" dimension of a part made of average machine steels becomes 4.00132" when that piece has been subjected to a 50°F temperature rise. For quick reference in precision inspection and measuring and for designers' use in establishing tolerances is a table of variations in part dimensions vs. temperature changes compiled by the Acme Industrial Co., 206 N. Laflin St., Chicago, Ill. Entitled: "Increase Or Decrease In Size Of Machined Steel Parts Due To Differences In Temperature of Room And Part To Be Measured" the table shows the dimensional changes over a range of part sizes from $\frac{1}{16}$" to 5" due to changes or differences in temperature of from 50°F in increments of 5° The calculations are based on a coefficient of linear expansion of .0000066" per degree F per inch of length as representing an average for steels (except stainless) generally used in machine parts. **59-D**

COMPRESSOR CALCULATOR SLIDE RULE—An ingenious compressor calculator designed to save critical time in computing compressor requirements or in estimating the performance of present compressor units has been prepared and a sheet of complete instructions accompanies each.

Of slide rule design, the unique engineering tool can be used for quickly estimating the volumetric efficiency, brake horsepower and total piston displacement of any make of compressor although it was originally intended for use primarily with Cooper-Bessemer's Type G-MV engine driven compressor units.

The calculator which is made of heavy stock is pocket size, measuring 3½" by 8½".

It reflects many years of technical and compressor-building experience and has proved so useful that it is now offered gratis to all responsible engineering and operating executives as long as the supply lasts.

Requests should be directed to The Cooper-Bessemer Corp., Dept. J, Mount Vernon, Ohio. **85-D**

RECOMMENDED SPINDLE SPEEDS AND CUTTING FEEDS—for End Mills ranging in diameter from $\frac{1}{16}$" to 2" are shown in two colors on a substantial oil and grease resistant chart recently issued by the Weldon Tool Co., 3006 Woodhill Rd., Cleveland 4, Ohio. For each of the end mill diameters included, the chart lists the respective Spindle Speeds and Cutting Feeds for Cast Iron, Machinery Steel and Tool Steel. Large enough for wall use, the chart is not too large for posting at the individual machines. Requests from executives, instructors, or department heads will be granted prompt fulfillment. **517-D**

GENERAL METALLOGRAPHY by Ralph L. Dowdell, Professor of Metallography, University of Minnesota. Henry S. Jerabek, Assistant Professor of Metallography, University of Minnesota. Arthur C. Forsyth, Assistant Professor of Metallurgical Engineering, University of Illinois. Carrie H. Green, Teaching and Research Assistant, University of Minnesota.

Published by: John Wiley & Sons, Inc., New York.

This book is admirably suited to beginning students of Metallography or to serve as an introduction, for engineers, to the many specialized books and the vast amount of technical information constantly

(Continued on Page 172)

Minimize TOOL CRATERING and BREAKAGE use KENNAMETAL CARBIDE TOOLS

★ Necessity for frequent replacement of cutting tools all-too-often interferes with production schedules. Service life may be shortened by excessive wear due to cratering, or breakage.

KENNAMETAL tools have proved to be much less susceptible to these detrimental possibilities than other types.

They have greater resistance to cratering. Steel chips do not adhere to KENNAMETAL tips—containing tungsten titanium carbide—because of the great dissimilarity between the metals in the tool and chip.

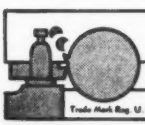
KENNAMETAL tips are close-grained, hard and strong, with greater resistance to rupture stress, able to withstand the heavy load of coarse feeds, and maintain a keen cutting edge.

Because of these characteristics KENNAMETAL tools will speed up production, assure a uniformly smooth precision surface, will extend tool service between grinds, and lengthen ultimate life.

Write for your copy of the Kennametal Tool Manual. It gives complete information about the uses of this superior steel-cutting carbide, and means to assure the longest possible tool life.

IMPROVED DELIVERIES

Expanded production facilities of Kennametal Inc., permit prompt shipment of standard tools and blanks, lathe centers, grinder centers, and special items.



KENNAMETAL *Inc.*

500 Lloyd Ave., Latrobe, Pa.

Trade Mark Reg. U. S. Pat. Off.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

(Continued from Page 170)

published. The various subjects are presented in most logical order thus facilitating laboratory work accompaniment. With few exceptions, the micrographs are from the authors' collection prepared in the metallographic laboratories of the University of Minnesota. Quite definite information on commercial alloys has been included because the authors know that the engineer in the metal working industries needs more than a theoretical treatment of the subject inasmuch as he has to work with the alloys available on the market and needs definite information as to their characteristics. Tables of physical and mechanical properties make this work still more valuable as an elementary reference book on metals and alloys. Chapter titles include: Crystallization and Crystal Structure; Alloy Systems and Constitution Diagrams; Classification of Constitution Diagrams; Pyrometry; Mechanical Properties; Metallographic Control (Inspection and Control, Microscopic Examination, Metallographic Microscope); Cold Working, Plastic Deformation, Strain Hardening; Iron and Steel; Nonferrous Metals and Alloys; Corrosion.

HOW TO TRAIN SHOP WORKERS by C. A. Prosser, Ph. D., Director, Dunwoody Industrial Institute, in collaboration with Philip S. Van Wyck, Head, Metal Trades Dept., Dunwoody Industrial Institute. Published by American Technical Society, Chicago, Ill.

A shop training manual for use by foremen and instructors in the training of workers in production and service jobs. This training manual has been "tooled up" to serve a double purpose. One—that it shall prove helpful to shop foremen for training workers in any mechanical occupation, and two—to assist vocational instructors in all day, part time and evening schools and classes. In the discharge of his responsibilities, the foreman should be: a manager who plans—a supervisor who checks and corrects—and an instructor who trains his workers. The shop instructor in a vocational school has the same three responsibilities and this manual deals primarily with the third—the training of learners in efficient habits of work and of workmanship. Parts 1 and 6 constitute helpful material regarding both the management and supervision of learners—whether workers or students. The body of the manual—parts 2 to 5 inclusive—focuses on the problems facing both the foreman (or his assistant trainer) and the school shop instructor as to what to teach the learner and how to teach it.

How else could you do this job economically?

To weld all seams and joints of this complex weldment down hand, the weldment had to be tilted, rotated, twisted, and turned—had to be held in a score of different positions. This is easily done with a C-F Positioner, for at the push of a button it will rotate a weldment (thru 360°) or tilt it (thru 135° beyond horizontal).

Without a Positioner it would require almost constant attendance of a crane and its sling crew, with horses and plenty of floor clearance for handling.

C-F Welding Positioners come in sizes and capacities up to 30,000 lbs. All are pedestal mounted and are adjustable for height.

Write for Bulletin WP-22

CULLEN-FRIESTEDT COMPANY
1316 S. Kilbourn Ave., CHICAGO 23, U.S.A.

Precision Grind CUTTERS AND END MILLS

Girl operator precision grinding ½" dia. 2-Flute High-Speed Steel End Mills, sharpened to a 15° cutting angle. Total time required to grind cutter from hardened and ground blank is 5 minutes per cutter.

TYPICAL EXAMPLE OF CUTTERS GROUND ON THIS GORTON GRINDER

Shown are a few examples of the wide range of cutter grinding accomplished on the Gorton 375-2.

Save Time and Money . . . with a GORTON CUTTER GRINDER

This manufacturer has four Gorton 375-2 Cutter Grinders for sharpening cutters and mills used on a number of precision machines, including three Gorton Pantograph Engravers and a Duplicator.

Girls operate all four grinders. It requires only about two months to develop a girl's skill sufficiently to perform the most critical grinding operations on most types of precision cutters and end mills.

COMPLETE SET OF CUTTERS AND END MILLS WITH FREE HANDY CUTTER RACK FURNISHED

This convenient rack is furnished free with assortments of Gorton Cutters and End Mills. Saves time and money on mold and die work.

OUR GOLDEN ANNIVERSARY 1893-1943

ACCURATELY GROUND TOOLS are indispensable to Super-Speed precision milling. The Gorton 375-2 Cutter Grinder grinds cutters with 2, 3 or 4 flutes, or flats . . . any diameter, taper, radius or clearance within the capacity of the machine. With diamond impregnated wheels (interchangeable with standard wheels), tungsten carbide cutters can also be ground.

Install a Gorton 375-2 Cutter Grinder for increased accuracy and production with smoother finish in your milling operations.

No. 375-2 Grinder, equipped with No. 717-1 Universal Tool Head and No. 9761 Pedestal, complete, ready to operate..... **$612**

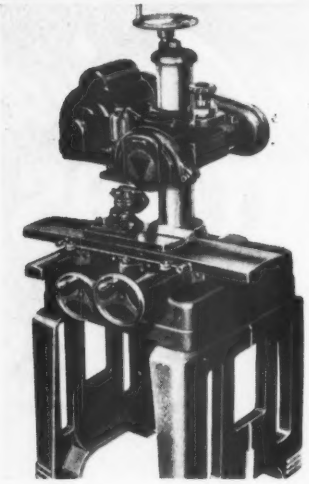
FREE

For complete details and additional accessories write for *Gorton Accessories Catalog* offering 580 aids to production.

GEORGE GORTON MACHINE CO.

1319 RACINE STREET, RACINE, WISCONSIN, U.S.A.

FOR OVER 50 YEARS Specialists in "Tracer-Controlled" Machines



New Delta Chip Breaker Grinder

ONE of the outstanding features of the Delta Manufacturing Company's new Chip Breaker Grinder is the Univise which holds work at any desired angle. By removing this Univise, the grinder can be used as a surface grinder which greatly increases its usefulness. Production men who have seen this big, heavy, accurate machine have been astonished at its low cost. It is designed for grinding the chip-breaker groove in Carbide tipped tools, but is also used for grinding form tools, thread chasers and other units which must be accurately ground.

An unusual feature is a unique wheel-mounting arrangement that utilizes a two-piece adapter, so that either wheel, or wheel and adapter, can be removed. This new chip-breaker grinder also has a carefully designed spindle, which is the "heart" of any grinder. A specially designed column made of one-piece construction, cast of hi-tensile iron, normalized and accurately ground to close tolerances, is another exclusive feature. A steel gib guides the bracket yoke so that it is always in perfect alignment. The entire column, together with the bracket, may be rotated 360°.

Further information may be had by addressing The Delta Mfg. Co., 612H E. Vienna Ave., Milwaukee 1, Wis. 51-D

Cartridge Case Dies
. . . WITH TALIDE NIBS made of Solid Tungsten Carbide, are producing millions of primer cups, small arms ammunition cases and jackets, and cartridge cases in sizes 20 m/m to 105 m/m with Better Finish, Longer Life, Closer Tolerance and Fewer Rejects . . . including cupping, drawing, tapering, sizing and pointing operations.
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METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO
TUNGSTEN CARBIDE TOOLS · DIES · WEAR PARTS

Why Worry About

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Just Call or Write Die Supply Co.!

We carry complete stocks of die springs in three standard types, medium pressure, medium high pressure and high pressure, to meet all requirements. Each spring is a precision-made product of the very best workmanship and material. Designed for accuracy, resiliency and minimum crystallization. Prompt shipments.

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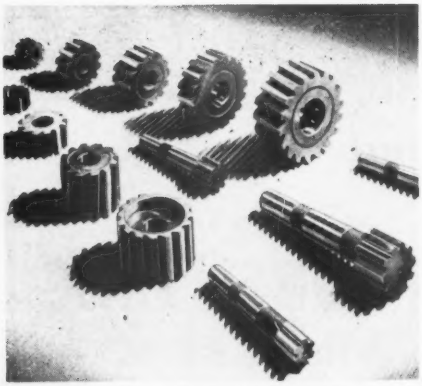
We can fill your requirements for all Die Maker's supplies, including structural glass Surface Plates and the amazing Hardsteel Drills that enable you to drill hardened steel without annealing. Send for complete information.

DIE SUPPLY CO.

4751 Hough Avenue **CLEVELAND 3, OHIO** **EXpress 1133**



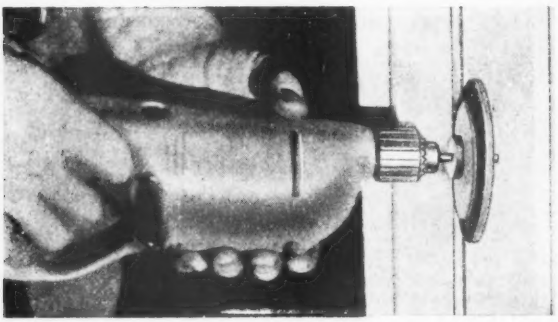
Thread Milling Cutters Standardized

TO speed delivery and simplify ordering of multiple thread milling cutters is the purpose behind the line of standardized thread milling cutters developed by Detroit Tap & Tool Co. Blanks for such standard sizes are now carried in stock, finish-machined and heat treated, ready for finish grinding of threads. To place an order for a "Detroit standard" it is now necessary only to specify the blank number and thread specifications desired. Blanks are then taken from stock and the threads ground to individual specifications.

Included in the line are both shell and shank type cutters. The diameter range of the 40 different shell type "standard blanks" is from 1½" to 3½". The number of flutes decided upon for the various sizes of standard blanks are those found to give the best combinations of tool life, accuracy and convenience of tool sharpening. Thus, the shell type blanks of 1½" diameter have 8 flutes; 1¾" to 2" diameters—10 flutes; 2¼" to 2½" diameter—12 flutes; 3" diameter blanks—14 flutes; and 3½" diameter ones have 16 flutes.

Hole sizes correspond to standard thread milling machine arbors. All shell type blanks have right hand spiral flutes and a 5° rake angle.

Detroit Tap & Tool Co., 8432 Butler St., Detroit 11, Mich., will send bulletin. 134-D



Do Your *DE-BURRING* with 1943 METHODS AND MATERIALS!

Here is one of the cases where all-in-one de-burring, finishing and polishing jobs have been accomplished in a single operation by Brightboy.

Time and work savings plus a smooth, precision finish which frequently serves as a final polish are achieved through Brightboy's original composition — resilient *rubber* impregnated throughout with abrasive.

Try Brightboy. Time the operation, compare the results. Write us if your dealer cannot supply you with Brightboy METHODS AND APPLICATIONS data, prices, catalogs. Our field men are at your service.

BRIGHTBOY INDUSTRIAL DIVISION
Weldon Roberts Rubber Co. Newark, N. J.

WELDON ROBERTS
Brightboy

14½" SOUTH BEND
TOOLROOM LATHE
SPECIFICATIONS
Swing over bed . . . . . 14-5/8"
Hole through spindle . . . . . 1-1/8"
Maximum collet capacity . . . . . 3/4"
Thread cutting feeds (48) . . . . . 4 to 224 per inch
Spindle speeds 8
Power longitudinal and cross feeds 48

SOUTH BEND TOOLROOM LATHES

for Precision Machine Work

TRAINING HELPS

Sound films, books, wall charts, and bulletins are available for training lathe operators. Write for Bulletin 21-C.

Skilled craftsmanship combined with excellent design in South Bend Toolroom Lathes make them highly efficient for machining work to precision limits.

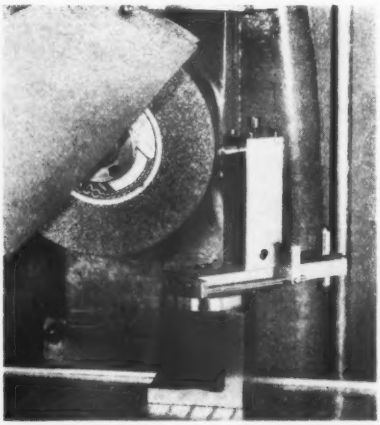
Their accuracy, speed, and smooth power assure fine finishes. Wide ranges of turning and facing power feeds, thread cutting feeds, and spindle speeds, plus ease of operation, help to simplify the exacting jobs.

South Bend Toolroom Lathes and Engine Lathes are made with 9", 10", 13", 14½", and 16" swings. South Bend Precision Turret Lathes are made with 9" and 10" swings. Write for Catalog 100-C.

ARMY NAVY

SOUTH BEND LATHE WORKS

SOUTH BEND 22, INDIANA • LATHE BUILDERS FOR 37 YEARS



All-Purpose Precision Dresser

IN response to the increasing demand for a low cost, all-purpose precision dresser for both angles and radius, the Form-Master has been developed. It is particularly suited on Brown & Sharpe universal surface grinders and similar type grinders.

Operation is simple. To obtain concave radius, simply adjust height of diamond to horizontal center of grinding wheel spindle. Obtain the center by fixing the diamond at 2.500" (mike from diamond point to back of plate) and setting micrometer pins at 3.500". Subtract from 3.500" setting for desired concave radius. Use adjustable stop for re-setting to same radius.

To obtain a convex radius, obtain the center and add to the 3.500" setting for the desired convex radius. For angles, remove the upright used for radii and tilt the fixture forward on the angle base. Adjust the height of the diamond to center of the grinding wheel spindle. Set the desired angle with protractor or sine bar at base.

All parts of the Form-Master are hardened (except the base) and ground to close tolerances. The cast iron base permits drilling and tapping of holes when needed for quick setups on a cylindrical grinder. When necessary, the Form-Master can easily operate in a horizontal position.

J & S Tool Co., 477 Main St., East Orange, N. J., has a new folder now ready for distribution. 339-D

Sheldon BBU-1240 WQ Precision Lathe

This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collet capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate thru a *standard* 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways—2 V-ways and 2 flat ways.

If interested in 10", 11" and 12" quality lathes be sure to see the SHELDON.

SHELDON MACHINE CO., INC.
4236 N. Knox Ave. Chicago, U.S.A.

Faster PRODUCTION

WITH

-SPEED-VISE-

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CARDINAL MACHINE COMPANY

GLENDALE, CALIFORNIA

"The -SPEED-VISE- Manufacturer"

HILL-CLARKE

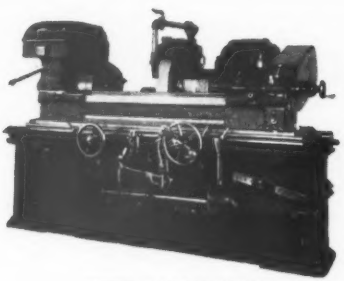
Modernized

CYLINDRICAL GRINDERS

for **SUPER-GRINDING**

and **MICRO-FINISH**

Hill-Clarke Modernized and Motorized Cylindrical Grinders offer refinements in design which minimize vibration and assure extreme accuracy on all grinding operations. One of these refinements, the Hill-Clarke Patented Multiple V-Belt Drive to work spindle, contributes to the smoothness in operation which makes possible a finish within a few micro-inches even when using standard grain free-cutting wheels. Investigate today by sending for a copy of the Hill-Clarke catalog "Super Grinding."



SIZES AVAILABLE

10x36	10x72	14x72	16x72
10x50	14x50	14x96	18x96

HILL-CLARKE MACHINERY CO.

646 WASHINGTON BOULEVARD CHICAGO, ILL.

INDUSTRIAL DIGEST

(Continued from Page 137)

Change in Van Norman Name

Effective September 16, 1943 the name of the "Van Norman Machine Tool Company" was changed to "Van Norman Company". Organized in 1912, the company's activities have expanded to include production of automotive service equipment and recently, in the field of electronics, induction heating equipment. The name change eliminates the implication that machine tools are their only products.

Enemy Patents

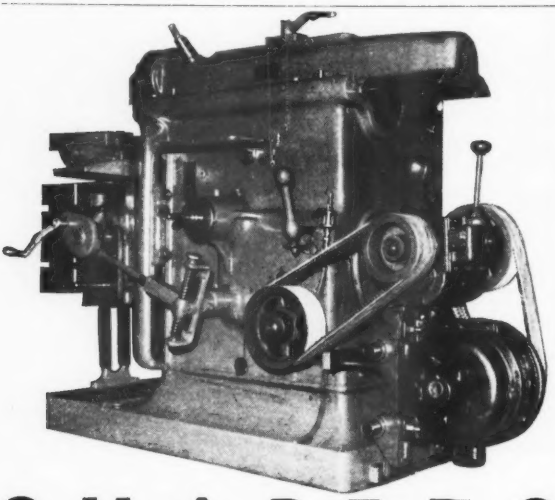
A WEALTH of source material is readily available to the machine and tool designer in over fifty thousand enemy patents and patents pending seized by the government since the war. The object of the seizure was to make these patents readily available to American industry and they are now dedicated to the people of the United States.

The patents are classified by subject matter in accordance with the U. S. Patent Office system of classification.

Random samples of class titles are: Abrading; Boring and drilling; Compound tools; Gear cutting; Milling and planing; Lubrication; Machine elements; Measuring and testing; Metal working; Optics; Plastics; Presses; Pumps; Tools; Valves; to a total of over three hundred classes ranging from three patents under "Bee Culture" to over two thousand pertaining to "Radiant Energy"!

A license application fee of $15.00 is charged for each single patent and in general licenses are issued to any reputable American firm or individual on a non-exclusive and non-assignable basis and are for the duration of the life of the patent.

(Cont'd on Page 182)



SHAPERS

Milling machines, lathes, automatics, radial drills, screw machines, etc.
Are motorized with Western MASTER (1-5 hp.) Transmissions with bracket..... $95.00
Western MAJOR (5-10 hp.) Transmission with bracket..... $145.00
and a Western SUPER capacity (up to 30 hp.); can be installed on lathes, milling machines, shapers, radials, sl oters, boring mills, gear cutters, die sinkers, etc.

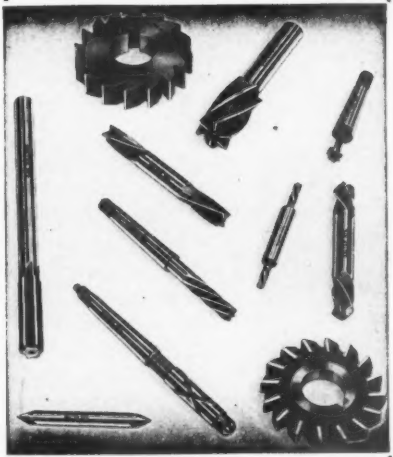
Send for catalog. Prompt deliveries on high priorities.

up to 30 h. p. For Motorizing Lathes, Milling Machines, Shapers, Turret Lathes, Radial Drills, Slotters, Bolt Cutters, Gear Cutters, Die Sinkers, Boring Mills, etc.
WESTERN TRANSMISSIONS

WESTERN MANUFACTURING CO. · 3400 SCOTTEN · DETROIT

IMMEDIATE DELIVERY
FROM STOCK
On Standard Sizes

GALTER
HIGH GRADE TOOLS



DEPENDABLE
PERFORMANCE
Guaranteed

Plain Milling Cutters
Side and Face Milling Cutters
Stagger Tooth Side Milling Cutters
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Slot Cutters
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Straight Shank Drills

Prompt Delivery on Special Tools, Dies, Jigs And Fixtures Made To Your Exacting Requirements

Write for prices on standard sizes or submit blueprints for quotations on special sizes.

Galter Manufacturing Co.
711 W. Lake Street - Chicago, Ill.

The Osborn Manufacturing Co., Cleveland, O., manufacturer of power brushing wheels, has appointed Armin L. Nevers as its technical representative in the state of Wisconsin. Mr. Nevers recently completed a several months' period of special training in the Osborn factory.

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CENTERING
CHUCK SAVES
TIME • SAVES
MONEY

Now you can easily, quickly and economically convert any medium sized drill press into a centering tool with the efficient Universal Centering Chuck.

With this chuck work from screw machines that has been centered on one end can be set on the press and rapidly centered on the other.

A feed adjustment regulates the depth of center. Concentricity and uniform depth of centers are maintained. Write for further facts.

UNIVERSAL ENGINEERING
FRANKENMUTH,
MICHIGAN

(Continued from Page 180)

U. S. Patents

Those interested in further investigation need simply request copies of both "Patents at Work" and the "Index of Patents vested in the Alien Property Custodian" from the Office of Alien Property Custodian, Chicago, Ill.

Titles and serial numbers of recently issued U.S. Patents of Tooling Interest:

Method of and Apparatus for Assembling Stators, 2,327,352; Clinch Nut Press, 2,327,401; Deburring Machines, 2,327,407; Continuous Milling, 2,327,531; Die Construction, 2,327,665; Cushioning Tool Holder, 2,327,685; Punch Device, 2,327,715; Universal Work-Holding Plate for Magnetic Chucks, 2,327,748; Floating Tool Holder, 2,327,897; Height Gage Arm Attachment for Universal Dial Indicator, 2,327,948; Tool Holder, 2,328,359; Tool Holder, 2,328,477; Gear Finishing Tool, 2,329,284.

If you are interested in studying any of the above Patents simply advise Patent Information Service, The Tool & Die Journal, 2460 Fairmount Blvd., Cleveland 6, Ohio, enclosing 20 cents for each patent desired and we will gladly forward your order to Washington.

RESHARPENING NEVER CHANGES THEIR FORM

It's the unusual design of Bokum Tools —providing proper angles and clearances—that makes possible increased feeds and speeds for precision boring, bottoming and facing, and internal threading. Available in sizes to bore holes from 3/32" up.

When asking for catalog, specify E-1139 for high speed tools, or E-398 for carbide-tipped tools.

BUY WAR BONDS

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14775 WILDEMERE AVE. · DETROIT 21, MICH.

The DoAll Products Exposition and Service Clinic recently held at Des Plaines, Ill., presented two objectives

DoAll Exposition Aimed at Post War Expansion

to its representatives: the importance of giving industry service fundamental to the efficient operation of DoAll machines now producing war materials and the presentation of new products which are the outgrowth of Continental Machines' revolutionary principles of contour

(Cont'd on Page 184)

In War, as in Peace . . .

CERRO ALLOYS

SAVE TIME and CUT COSTS!

CERROMATRIX (Melting Temp. 250° F.) For securing punch and die parts, anchoring machine parts without expensive drive fits, short run forming dies and other metal-working applications.

CERROBEND (Melting Temp. 158° F.) Used as a filler in bending thin-walled tubing to small radii. Easily removed in boiling water. Also used for aircraft assembly jigs, templates for forming dies and other purposes.

CERROSAFE (Melting Temp. 190° F.) Used to accurately proof-cast cavities such as molds, gun chambers, forging dies, etc. and for many similar applications.

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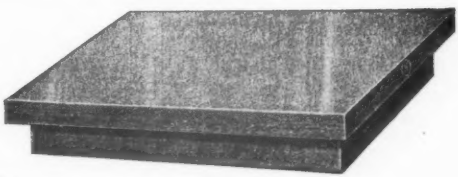
CERRO DE PASCO COPPER CORPORATION
40 WALL STREET - - - - NEW YORK, N. Y.

HERMAN
PRECISION GRANITE
SURFACE PLATES



Distinctly New . . . Definitely Superior

Herman PRECISION GRANITE Surface Plates eliminate once and for all the disadvantages and uncertainties of old-fashioned metal surface plates. Cut from solid granite, they cannot warp and will remain accurate to 1/10,000 inch overall. Practically non-porous, they do not become charged with tool damaging abrasive particles. Corrosion and rust-proof, they are as nearly indestructible as man and nature can make them. Already scores of shops throughout the country have declared them unequaled for precision work. Let Herman PRECISION GRANITE Surface Plates increase production efficiency and economy in your shop. Write today for full information.

THE HERMAN STONE CO.
1242 Leonhard St. Dayton, Ohio

Standard Sizes and Weights

12″ x 18″	—	75 lbs.
18″ x 24″	—	160 lbs.
20″ x 30″	—	275 lbs.
24″ x 36″	—	480 lbs.

Custom Sizes on Request.

Prices are Reasonable

(Continued from Page 182)

sawing and filing embodied in the DoAll machine. Products exhibited include a new type of high speed sawing machine, saw bands, hack saws, automatic butt welders, precision gage blocks and instruments, precision grinders, selectrons, chucks, grinding wheels, a continuous band filing machine—all designed for more efficient operation in peace-time production. The clinic was sponsored by Continental Machines, Inc. and its six associate companies—DoAll Co., Savage Tool Co., Contour Saws, Inc., File Bands, Inc., Alloy Metals Division and the Speedmaster Co.

Photoelastic Study of Presses in Gear Tooth Fillets

Messrs. Dolan and Broghamer have carried out a series of investigations on photoelastic models at the University of Illinois (Urbana, Ill.), purpose of which was to determine the maximum stress developed in the fillets of several representative gear teeth by using bakelite models and utilizing the well-known photoelastic method of stress analysis.

The photoelastic method of stress analysis consists in loading flat transparent bakelite models in monochromatic polarized light and observing the order of the appearance of interference fringes produced on the image of the models as the loads are gradually increased. These fringes represent loci of constant intensity of maximum shearing stresses or lines along which the difference of the two principal stresses are constant in magnitude.

The bakelite models were securely fastened to a rigid frame and arranged so that they could be shifted or rotated to any desired position in a vertical plane. The tooth forms selected for the models were those of standard gear teeth and were chosen to illustrate the relative influence on the stress concentra-

(Cont'd on Page 186)

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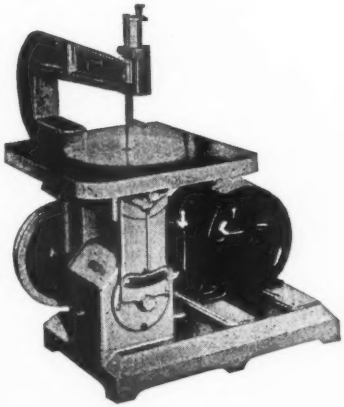

ATLAS DIE FILING MACHINES

Can be used for all kinds of die making. The overarm is constructed so that the file and saw attachments may be interchanged with little effort. The hold-down fingers are attached directly to the overarm. Working surface of the table, which tilts two directions, is entirely clear. An improved type of chuck, consisting of movable hardened jaws, holds both saws and files. Screw adjustment makes changes easy and fast.

COMPLETE WITH MOTOR—$125 NET
F.O.B. CHICAGO

Detroit Distributor:
International Machinery Co.
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ATLAS EQUIPMENT COMPANY
101 S. CLINTON ST., CHICAGO, ILL.

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"Let us recondition your Tap Extractors"

Send us your damaged tap extractors. All broken holders, collars, and sleeves will be replaced without charge. Steel fingers replaced at standard list prices. Put your Waltons in condition now. 48-Hour Service.

TOOLS ARE WEAPONS;
TREAT 'EM RIGHT.

★NO ANNEALING
★NO DRILLING
★NO DAMAGED THREADS
★NO COSTLY DELAYS

Immediate Shipment; stock sizes #4 to 1½", 2, 3, 4 flutes; 30 day free trial.

Write for folder No. 13

The WALTON Company
94 ALLYN STREET · HARTFORD, CONN.

(Continued from Page 184)

tion factor of some of the variables involved in gear design. Each model contained one full tooth and half of each of the two adjacent teeth.

Loads were applied in three positions and tests were made with varying fillet radii, the load positions being chosen to cover that portion of the tooth normally subject to actual loads during the period of engagement. The loads were applied by dead weights through a single lever loading arm and transmitted to the model through a pivoted loading block.

The detailed results of the various tests are presented in tabular form in the bulletin issued by the University.

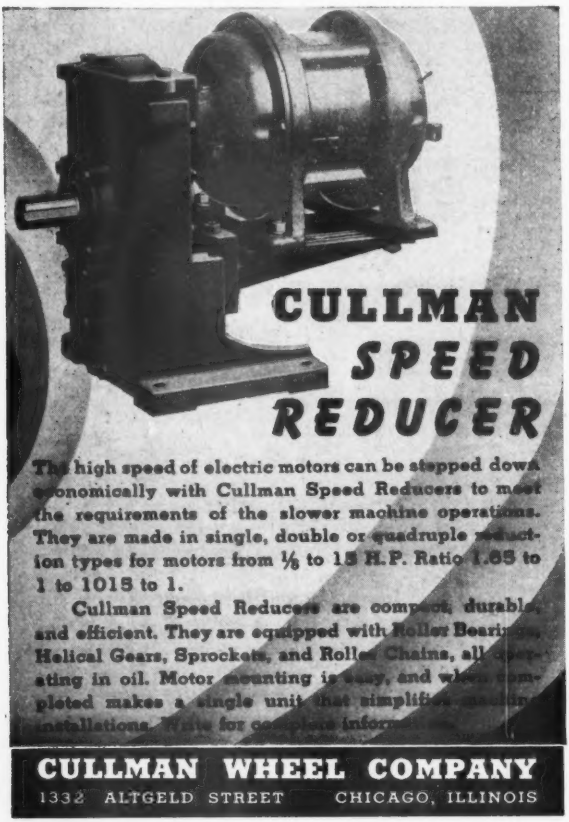
A condensation from "Photoclastic Study of Stresses in Gear Tooth Fillets" originally published in the August issue of Machinery Lloyd, England.

Additional "E" Awards

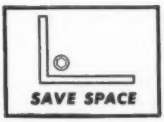
The Bryan, Ohio, plant of the Aro Equipment Corporation has been awarded an added White Star for its Army-Navy E Flag, denoting continued outstanding service since the original award. Production of this company serves the "fighting front" with aircraft products; the "production front" with pneumatic tools for war plants; and the "home front" with lubricating equipment to keep essential transportation rolling.

Workers and officials of the Brown Instrument Co., division of Minneapolis-Honeywell Regulator Co., have been cited for "outstanding production of war material" and have received the E award. The award represented recognition of the company's record in the making of war equipment and materials, involving the production of instruments for metal working, chemical and process, oil, food and textile industries.

(Cont'd on Page 188)

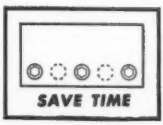

CULLMAN
SPEED
REDUCER
The high speed of electric motors can be stepped down economically with Cullman Speed Reducers to meet the requirements of the slower machine operations. They are made in single, double or quadruple reduction types for motors from ⅛ to 15 H.P. Ratio 1.65 to 1 to 1015 to 1.
Cullman Speed Reducers are compact, durable, and efficient. They are equipped with Roller Bearings, Helical Gears, Sprockets, and Roller Chains, all operating in oil. Motor mounting is easy, and when completed makes a single unit that simplifies machine installations. Write for complete information.
CULLMAN WHEEL COMPANY
1332 ALTGELD STREET CHICAGO, ILLINOIS

Yes, these screws save Time and Space!



No matter how close to a corner or flange you put Mac-it hexagon socket screws, there's plenty of room to drive them. Use this advantage to save space.

★ ★ ★



Mac-its are heat-treated to give far greater strength than plain steel screws. With that extra holding power, you may be able to use fewer screws—save drilling and tapping time.

Mac-its

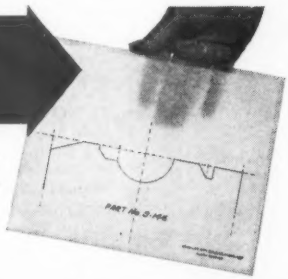
PRONOUNCED "MACK-IT"

4311

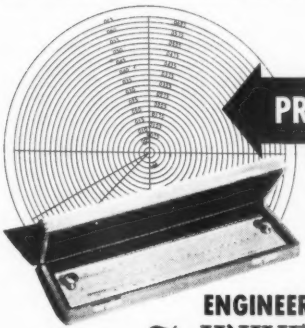
OTHER MAC-IT PRODUCTS INCLUDE: Socket head and hexagon head cap screws, stripper bolts, hollow and square head set screws, hexagon socket pipe plugs.

Strong, Carlisle & Hammond Company • Cleveland, Ohio

ENGINEER'S-GLASS (Glass-backed Vellum) for COMPARATOR CHARTS



● No shrinking, no stretching, no buckling. Write for 16-page booklet, "Helping You to Get the Utmost from Your Projection Measuring Equipment."



PROJECTOR RULES • RADIUS CHARTS

● For use with all types of comparators, micro and measuring projectors. Radius charts supplied for magnifications of 10x — 20x — 31.25x — 50x and 62.50x.

ENGINEER'S SPECIALTIES DIVISION

The UNIVERSAL ENGRAVING & COLORPLATE COMPANY

INCORPORATED

590 MONROE STREET · BUFFALO–NEW YORK

TWIN PLANTS

1921 EAST 19TH ST. CLEVELAND – OHIO

INDUSTRIAL DIGEST

(Continued from Page 186)

Wisconsin Claims First World War II Apprentice Toolmaker

At its West Allis plant the Allis-Chalmers Manufacturing Company recently indentured the first service-connected disabled veteran in Wisconsin. The young man is Robert Bucholtz and he is learning the trade of toolmaker.

The program of placement and training of returning disabled veterans is accomplished through the signing of an agreement between the Veterans Administration and the individual employer. It was under such an agreement that Bob Bucholtz was regularly indentured under the Wisconsin law as an apprentice. The state certificate of apprenticeship which will be issued him upon completion of his war services will incorporate recognition of his war services. This is an excellent example of close coordination between industry and state and federal agencies interested in apprenticeship. The federal agencies involved are the Federal Committee in Apprenticeship and the Veterans Administration.

War Plane Specifications
Require Torquing
Modern manufacturing methods call for controlled "settings" of vital nuts, screws, bolts, hydraulic fittings—of almost all threaded parts. Leading American aircraft and engine builders almost universally use the permanently accurate STURTEVANT TORQUE WRENCHES for innumerable applications ranging from building precision instruments to testing frictional drag in controls and motors. 50 models, capacities ranging from 0 to 5 in. pounds on up to 7200 in. pounds.
Write for catalog sheets.
Model F-100-I
(Capacity 0-100 in. lbs.)
Illustrated
P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

Rust — Not Bugs!

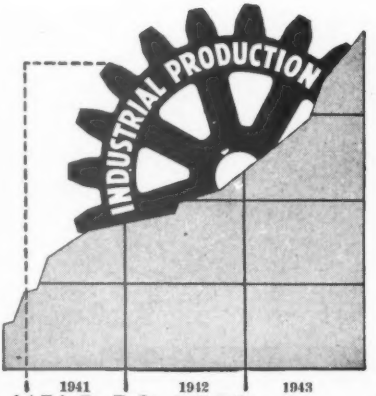
During a recent visit in a manufacturer's toolroom our snooping gaze came to rest upon a plainly labelled "Flit" spray gun which was surprising because we were up six floors, usually considered well above the fly and mosquito "ceiling". Diplomatic investigation disclosed that the contents was made up of paraffin dissolved in carbon tetrachloride. This, when sprayed on scales, verniers, gage handles and other fine surfaces, gives excellent protection against both atmospheric moisture and finger acidity. The carbon tet spray will penetrate into the most minute spaces yet evaporates almost immediately thus leaving a thin protective film of paraffin.

The Heller Brothers Co. of Newark, N. J., manufacturers of files, rasps, tools and steel, has recently acquired the goodwill, trade name and patents of the Cleveland File Company, Cleveland, O.

UNIVERSAL MIKRO-LOK PRECISION BORING BARS

Tooling is now going forward to get on a production basis so that orders for the new Universal Mikrolok Precision Boring Bars can be filled more promptly. Universal Mikrolok Boring Bars can be adjusted as quickly and easily as a micrometer to limits of .0005 or less. Mikrolok cutting tools are extremely rigid, are available with taper shanks for Swiss Jig Boring Machines and with Morse shanks, straight shanks and a variety of flanges for Diamond Boring machines. Write for catalog.

UNIVERSAL ENGINEERING
FRANKENMUTH, MICHIGAN



HELP TO KEEP IT ROLLING

Use UNBRAKO

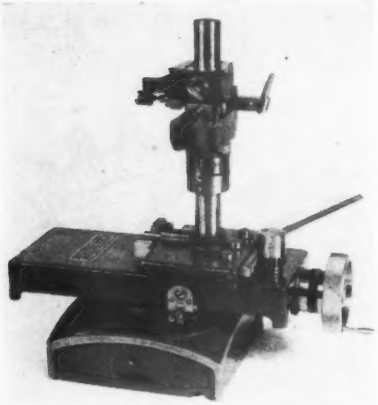
REG. U. S. PAT. OFF.
KNURLED
Socket Head Cap Screw

Knurled heads eliminate time-wasting finger slip and lost motion are a definite aid in maintaining and furthering the present high level of industrial production. Remember this next time you order — and be sure to specify "Unbrako" Socket Cap Screws with *Knurled Heads*. Available in all sizes from No. 4 to 1½" diameter. Catalog gladly sent upon request.

Knurling of Socket Screws originated with "Unbrako" years ago.

Over 40 years in business

Standard Pressed Steel Co.
Box 600, Jenkintown, Penna., U. S. A.



Microform Wheel and Tool Former

THE Microform is engineered—with available attachments—to support forming tools to be completed on tool and cutter grinders in record time, without first forming the wheel. For example, a tool bit requiring hours to grind to template can be fashioned to mechanical precision in thirty minutes. The Microform is used to obtain keen, sharp outlines, a semi-micro-inch finish and precise uniform clearances in forming difficult contours on tool bits, milling cutters, die sinking tools and other forming tools for metal or wood.

Similar lines on grinding wheels may be obtained with smooth, sturdy precision without tool attachments. A compound slide assures angles tangent to radii by simple manipulation. Vertical and horizontal diamond nibs are furnished for completing 180° concave radii from 2″ to 3/16″ and convex radii from 2″ to zero.

The vernier graduated base is slotted and centered for flexibility of mounting on various machines, including cylindrical and magnetic surface grinders. A spring clutch dial graduated in .001″ assures precise control.

Included among the many constructional features of the tool are a diamond locater gage to set diamond on center, V-slots for dowel pins for clearance on tools.

W. F. Meyers Co., 1016 14th St., Bedford, Ind., will send literature & prices at your request. 677-D

This BOOK tells how to speed your Inspections

Send for your free copy

with the *New*

TRICO MICRO-CHEK

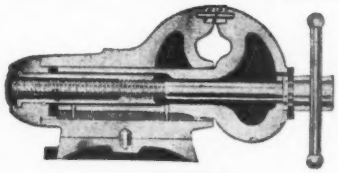
PRODUCTION GAGE

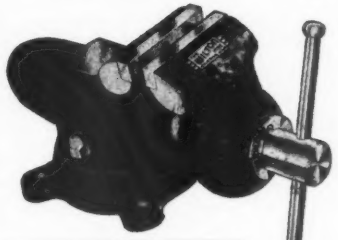
Priced from $9.75 up

More than 2700 war plants now use thousands of TRICO MICRO-CHEKS to speed up the gaging of millions of precision parts. With it, inexperienced workers quickly become dependable inspectors. Our new booklet shows many further uses of this accurate, speedier gage. Write for this timely information.

TRICO

TRICO PRODUCTS CORP.
Room 125 Trico Building, Buffalo, N. Y.





UNRESTRICTED 5 YEAR GUARANTEE

Send for Precision Production Tool Catalog No. 42

SOMETHING REALLY NEW IN BENCH VISES

- INDESTRUCTIBLE
- INTERCHANGEABLE JAWS
- NO SIDE TWIST OR WOBBLING
- PRECISION GUIDED STEEL KEY (at base)

SIZES AND PRICES
(Subject to Discount)

Width of Jaws	Maximum Opening	Approx. Weight	Price Without Swivel	Price With Swivel
2″	2″	10 lbs.	———	$10.40
3″	4½″	19 lbs.	$10.50	12.80
4″	5¼″	37 lbs.	16.40	18.60
4″ Heavy Duty	7″	48 lbs.	17.90	21.00
4½″	5¼″	40 lbs.	19.10	21.30
4½″ Heavy Duty	8½″	55 lbs.	23.00	27.50
5″	8½″	58 lbs.	28.00	33.60
6″	9½″	106 lbs.	48.50	62.00

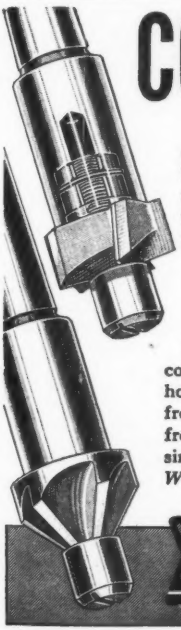
Extra Jaws Available

	2″	3″	4″	4½″	5″	6″
Smooth, Precision Ground Steel, Hard or Soft...	$1.65	1.90	2.85	3.30	4.40	5.50 pr.
Brass or Copper, Smooth.....	2.00	2.20	3.10	3.65	5.50	6.45 pr.

Sizes 3″, 4″ H. D., 4½″ H. D. and 6″ are built to conform to Federal Specifications GGG-V-436 as required by Army, Navy, etc.

Good Delivery on Most Sizes

ACME TOOL COMPANY - 196 CHURCH STREET NEW YORK 13, N. Y.



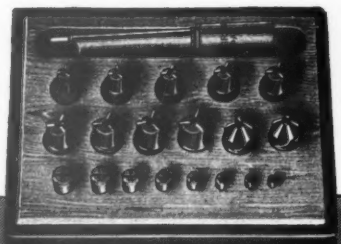
COUNTERBORE SETS

Today's war production program demands accurate, efficient cutting tools *within easy reach.* Gairing standard kits provide the answer for counterboring and spotfacing operations. Seven sets from which to choose. Each contains a logical assortment of *interchangeable* counterbores, pilots and holders boxed in sturdy cases.

THE GAIRING TOOL CO., Detroit, Michigan

For a quarter century specialists in fine cutting tools.

The set illustrated here consists of one Type A-1 holder, 9 cutters ranging from ¼″ to ½″, 8 pilots from $\frac{5}{32}$″ to ⅜″, 2 countersinks ½″ dia., 70° and 82°. *Write for catalog and prices.*



Gairing TOOLS

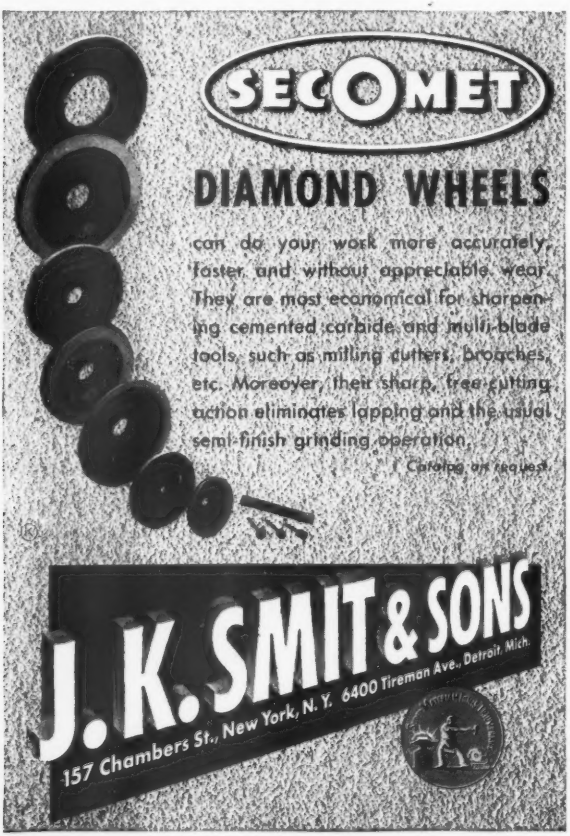
Rigid Design of Grinders Insures Precision

THE improved Reid Automatic Feed Surface Grinder embodies the latest trends in machine tool manufacture plus over thirty years' experience in building precision surface grinding equipment. Features incorporated in the design include a spindle of B3x Hy-Ten steel heat treated to 40 Rockwell C, ground and lapped. The spindle runs in a phosphor-bronze front box having adjustment for wear and is supported in the rear by two preloaded SKF ball bearings.

Vertical movement of the spindle is controlled by a centrally located hand wheel graduated in half thousandths. The work table is 51″ x 8″ over all and has a working surface 18″ x 6″. The longitudinal table travel may be actuated either by hand or power and the hand wheel is automatically disengaged during operation of power feed. Transverse table feed is automatic and its range of .006″ to .110″ per each table reversal is determined by a simple adjustment on front of machine. Transverse feed hand wheel is graduated in thousandths.

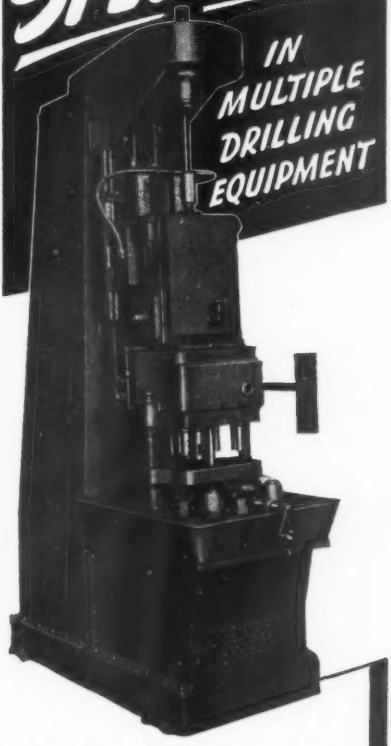
The massive pedestal base of the Leach External Grinder contributes toward smoothness and accuracy in work on parts up to 7″ diameter and 11″ length. Other features include: 452 square inches of hand scraped bearing areas, power feed, and six table speeds.

Detailed specifications and illustrated literature may be had from H. Leach Machinery Co., 387 Charles St., Providence, R. I. 801-D


SECOMET
DIAMOND WHEELS
can do your work more accurately, faster, and without appreciable wear. They are most economical for sharpening cemented carbide and multi-blade tools, such as milling cutters, broaches, etc. Moreover, their sharp, free-cutting action eliminates lapping and the usual semi-finish grinding operation.
Catalog on request
J. K. SMIT & SONS
157 Chambers St., New York, N. Y. 6400 Tireman Ave., Detroit, Mich.

SPECIALISTS

IN MULTIPLE DRILLING EQUIPMENT



Our Complete Facilities and Long Experience in Making Multiple Drilling Equipment for

DRILLING . . . REAMING . . . SPOT FACING . . . COUNTERBORING . . . TAPPING, Etc.

especially qualify us to take care of your individual requirements. Our Engineering Department gladly offer their services. Write us, giving details.

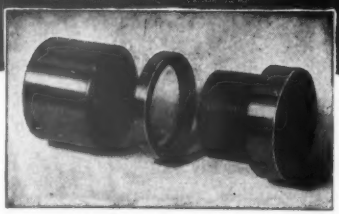
Pictured Above

is a special Hydraulic Drilling Machine; 9-spindle Drill Head Bushing Plate and Indexing Fixture.

MICHIGAN DRILL HEAD CO.

9211 E. 8 MILE ROAD HAZEL PARK, MICH.

"LITTLE THINGS THAT *Win* BIG WARS"



Adjustable Milling Spacer

A BIG bomber or tank is just an assembly of thousands of small parts, but each is vitally important in itself.

The Rousselle Adjustable Spacer is a little thing—but by saving time for your milling machine set-up men it can do its part in saving hours and hours of production time every month.

It slips onto the arbor between conventional spacers. A twirl of the wrist expands the Rousselle to the required setting, and the inner ring locks it securely. Thus tedious and time-eating spacer grinding is eliminated. Plain .001" graduations make accurate re-setting easy.

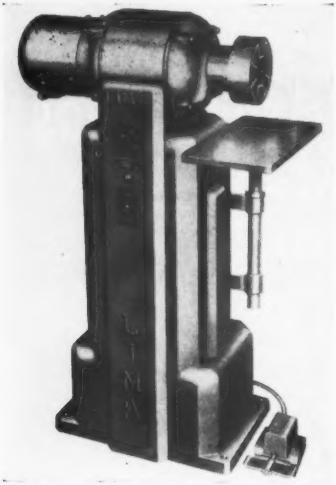
Rousselle Spacers fit all standard arbor diameters from ¾-inch to 4-inch bore. Precision to .001" is guaranteed.

Write for Bulletin TD-103 and prices.

PROMPT DELIVERY—Priority Certification Must Accompany Orders. Dealers: Write for Dealership Plan.

DAVID J. ROSS CO.

BENTON HARBOR, MICH.



Magnetic Polishing Lathe

A SENSATIONAL contribution, which offers a solution to perplexing problems of holding steel and other ferrous metal shapes for polishing, burring or lapping operations is offered by Lima Electric Motor Company to the Industry. This new development, the Lima Magnetic Polishing Lathe, has been designed for the specific purpose of speeding up production by eliminating the difficulties encountered in holding odd shapes or sections in a conventional chuck or collet. It is especially suitable for highly finished parts; leaves no chuck or collet marks.

A foot-pedal control, located in any position convenient to the operator, magnetizes the chuck, starts the motor, stops the motor and demagnetizes the chuck, leaving the operator free to use both hands for handling and processing the work. A magnetic disc-type brake for rapid stopping of the motor and chuck is supplied as standard equipment unless otherwise specified.

The unit is furnished with either single or two speed motors, 2 or 3 phase, with motor speeds to 3600 rpm. A self-contained rectifier unit supplies DC current to the chuck.

Other features include: easy accessibility of the entire unit for inspection of all parts; compactness for convenience of location and flexibility of operations; dust tight heavy duty bearings.

Recorded production increases of up to 300 percent with the magnetic polishing lathe are on file with:

Lima Electric Motor Co., 866 Findlay Rd., Lima, Ohio. Send for further details. 571-D

Vest Pocket Size
Right Triangle Reverse Side

Speed Production Thru Education of Personnel

This Amazing Chart Makes Trigonometry Easy

40 equations quickly found. Eliminates errors. Determines angles & dimensions, without knowledge of higher math.

Makes TRIGONOMETRY Easy

Machine Shop — Tool Die — Jig Bore — Patterns Layout — Inspection — Drafting

BREAK TIME-WASTING BOTTLENECKS with the TRIG-EASY CHART, for every man whose work requires solution of problems involving angles. Saves his own time and time of those who must wait for calculations.

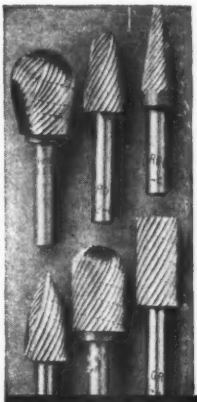
Correct equation is always instantly found with TRIG-EASY. 18,000 in use today. Pays for itself every time used. You can speed production thru education of personnel. Send for TRIG-EASY today, and only 50c with complete instructions. MONEY-BACK GUARANTEE.

TRIG-EASY

E. H. NEEDHAM

DEPT. 1-N. CULVER CITY, CALIF.

QUANTITY DISCOUNT TO INDUSTRIAL FIRMS



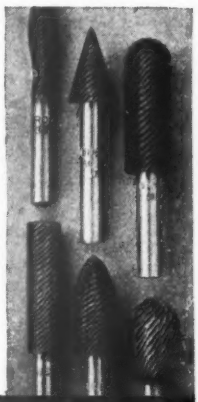
Grobet

ROTARY FILES

HAND CUT • MILLED CUT
GROUND FROM THE SOLID

There is a GROBET ROTARY FILE in shape, size and coarseness of cut for every type of hard or soft metal, plastic, wood etc. GROBET FILES do their jobs better and stay sharp longer.

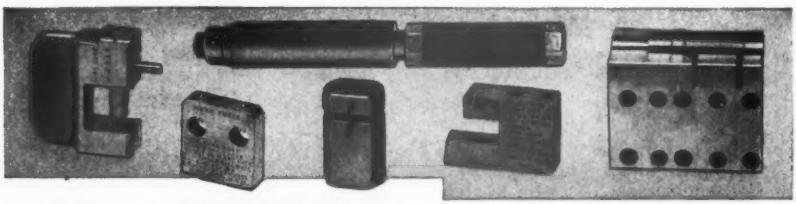
Send for catalog YR, the most complete of its kind illustrating and describing GROBET Rotary Files, Diesinkers, Burs, Tube Burring Cutters, Chatterless Countersink, etc.



GROBET FILE CO. of AMERICA

421 Canal Street 1812 1943 F. L. GROBET **New York, 13 N. Y.**

IMPORTERS OF GROBET SWISS FILES — MFRS. OF GROBET ROTARY FILES



GAGES TO MAINTAIN *"Uninterrupted Production"*

Many types of Gages are needed in large numbers to help carry out the program for War Munitions in vast quantities. • The ability of our skilled personnel and the capacity of our complete equipment, are directed toward maintaining the flow of uninterrupted production.

FEDERAL TOOL CORPORATION
400 N. Leavitt St.
CHICAGO, ILL.

Tap Grinder Has Interchangeable Chamfer Sharpening Heads

A COMPLETELY universal tap sharpening and reconditioning machine for tap users which is simple to operate and which will shape and relieve the chamfer, grind spiral points and sharpen the face of flutes, is offered by Henry P. Boggis & Co.

A distinguishing feature is the chamfer sharpening head, designed to sharpen taps within the listed capacities with three different numbers of flutes. This head is mounted directly on the left side of the base to provide the rigid setup necessary for precision work. The base is calibrated to permit recording and duplication of best chamfer angles for individual jobs.

The tap is held by the shank in a precision collet and rotated by means of the hand wheel, sharpening all chamfers at each revolution. The cams for 2, 3 and 4 flute taps (or any other specified combination of flutes) are mounted in the head and operated by means of three screws extending through the back of the head. The relief of the chamfer is variable, and adjusted by the same screws.

A LUCKY TOOLMAKER

WILL READ THIS AD!

In an attractive Wisconsin city on the shore of Lake Michigan where excellent living conditions prevail including good schools, fine churches and beautiful parks there is an exceptional opportunity waiting for a capable toolmaker. A nationally known company manufacturing precision electrical devices needs such a man for development work in their experimental laboratory. The position provides a liberal salary with an excellent future. It is the kind of connection that will be particularly attractive to a young family man who has definite ambitions for both himself and his children. In your reply kindly explain your qualifications in detail and, if possible, enclose a recent snapshot of yourself. Apply by writing to:

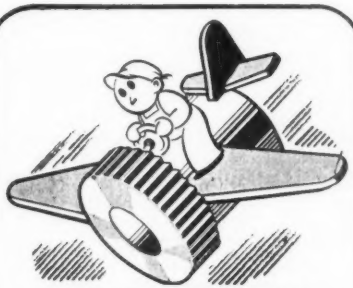
LUCKY TOOLMAKER AD
TOOL AND DIE JOURNAL
2460 Fairmont Blvd., Cleveland, Ohio

The Jominy end-quench hardenability test — what it is and how it has been modified to predict the performance of alloy steels — is a feature this month by Greswold Van Dyke of Joseph T. Ryerson & Son, Inc.

Longer tap life and control of close limit threads by enabling an operator to condition the tap for the material to be threaded is the aim of the Hybco Tap Sharpener.

Bulletin 51, by Henry P. Boggis & Co., 1277 W. Third St., Cleveland, O., is now available. Send for your copy. 802-D

The Austin Hastings Company, Inc., has recently been appointed as eastern New England distributors for Carpenter Tool Steels. Warehouse stocks of Carpenter Steels will be conveniently located in Worcester and Cambridge, Mass.

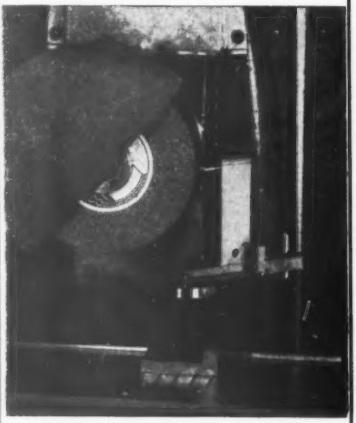


HIGH PRODUCTION OF UNIVERSAL DRILL BUSHINGS HELPS SPEED UP AMERICA'S WAR WORK

From coast to coast America's war plants are speeding their war work with Universal Drill Bushings. They are straight and round, have superfinished bores to insure accuracy and unexcelled wearing qualities. It pays to use Universal Drill Bushings. Write for catalog.

UNIVERSAL ENGINEERING
FRANKENMUTH, MICHIGAN

The FORM-MASTER
ANGLE AND RADIUS DRESSER



An all-purpose angle and radius dresser for high-precision at low cost. Accurate easily within .001". Simple to operate. Dresses in horizontal position enabling operator to SEE the form in work. All parts hardened and ground (except cast-iron base which can be drilled and tapped). Suitable for surface and cylindrical grinders. Two Brazilian 1/3 ct. diamonds and instrument case included.

It readily produces: Any desired angle; Convex radii to 4"; Concave Radii to 7". On 7" wheel.

Specifications: Base 3"x3", height 8½"; Wheel capacity 8"; Angular travel 3".

For information or a demonstration CALL YOUR SUPPLIER.

MANUFACTURED BY
J & S. TOOL CO. 477 Main St., East Orange, N. J.
PRECISION DRESSING TOOLS

Previews of Three New Shop Films

Federal Products Training Films—Two new educational films have been released by The Federal Products Corp., Sales Promotion Dept., 1144 Eddy St., Providence, R. I. These full color films are of educational value to tool engineers, inspectors and to trainees and may be borrowed or purchased.

The first film, having a running time of 20 minutes (800 feet), shows in complete detail the principles of precision measuring and it explains the meaning of tolerances, how they are applied to mass production and how the dial indicator is used to check them. Dial indicator mechanisms, accuracy of measurement, accuracy of repetition and sensitivity are all carefully explained through depiction of successful applications.

The second film of 18 minutes running time (700 feet) demonstrates dial indicator gages as used to control dimensions of interchangeable workpieces produced by mass production methods. Direct measuring dial indicator gages and gages for fast sorting of material for size are shown in use.

Scenes from the most modern shops where precision gaging is of great importance are shown and both production and final inspection scenes are illustrated and described in detail.

Jones & Lamson Training Films—A new sound motion picture entitled "Thread Grinding—Fully Automatic" has just been produced by the Jones & Lamson Machine Co. of Springfield, Vermont, from whom 16 mm prints are available for circulation among educational institutions, trade schools and associations interested in the subject.

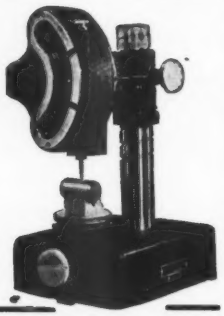
This film provides 28 minutes of highly interesting and instructive demonstrations of the setting up and operation of a fully automatic thread grinder.

Animation has been used to portray some of the more intricate and distinctive functions of their grinder and the film is of definite value to all who have occasion to be interested in the comparatively new technique of fully automatic production of precision ground threads in either large or small lots.

AMIC COMPARATOR

★

A Precision Indicating Gage



Our extensive experience will solve your measuring problems

DESIGNED to replace special gages, flush pin gages, snap, height gages. For accurate, convenient and quick checking of components, either in the tool room or on the production line. Permits precise gaging throughout the whole day without eye fatigue. Each division of the scale represents 1/10,000th of an inch. Interpolations of .00005 easily achieved. Clear readings on 6″ scale with inch and millimeter readings. Magnification is 1000. Measuring capacity is ±.003″ and ±.05 mm.

Accessories

NOTE our improved list of accessories designed to suit your particular measuring problems. Thread measuring device, serrated anvil, vee-blocks, centering fixture, ball anvil and several types of backstops.

AMERICAN MEASURING INSTRUMENTS CORP.

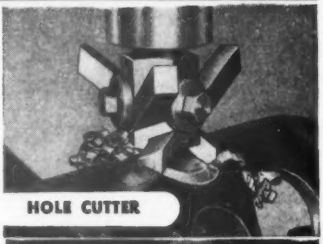
240 West 40th Street **New York, N. Y.**

MANUFACTURERS OF GAGES, JIGS, FIXTURES AND SERVICE TOOLS

HOW TO REPLACE CUTTING TOOLS that can't be salvaged!

When worn or broken cutting tools can't be reclaimed for further service, replacement should be made with tools that conserve vital materials, time and labor. CLARK CUTTING TOOLS comply with critical requirements, do better work quicker.

They use a minimum of tool steel (in cutting blades only); these can be resharpened repeatedly, replaced economically. Being adjustable, a few sizes do the work of many other tools, slash inventory. They make clean, *finished* cuts, reduce operations.



HOLE CUTTER

SURFACE FACER

EXAMPLE NO. 1

Clark Adjustable 3-Blade Hole Cutters make accurate, smooth holes in flat or curved metal, plastics, wood, transite. 7 sizes cut ⅜" to 5", up to 1" thick. No reaming or deburring. Fewer operations are required.

EXAMPLE NO. 2

Clark Adjustable 3-Blade Facing Tools. 4 sizes cover all fractional diameters, 1¼" to 5", do the work of End, Shell and Slab Mills, Inserted Tooth Cutters. Fit all machines. Tools available with all types of blades, including carbide tips.

Robert H. Clark Company
3424 SUNSET BLVD. • LOS ANGELES 26
MANUFACTURERS: PRECISION TOOLS, PRECISION PARTS

WRITE FOR BULLETIN NO. TD-10
In Canada: DOMINION BEARINGS, LTD. Toronto, Montreal, Winnipeg
Export: THE AMERICAN STEEL EXPORT COMPANY, INC., New York, Los Angeles

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KNOCK-OUT

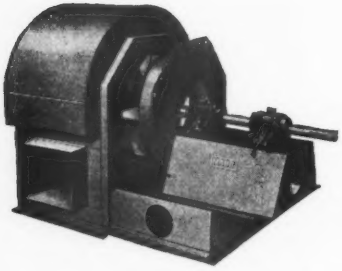
The New
K-O UNIVERSAL TOOL GRINDER

now coming off the assembly line. Maintenance or production with speed, accuracy, and dependability at minimum capital outlay.

Write for Bulletin UTG-43-TD.

K. O. LEE COMPANY
ABERDEEN SOUTH DAKOTA

Mahr Fans—for High and Low Temperatures



WITH a foundation of skill and experience and an intimate knowledge of the proper functions of an adequate temperature fan, Mahr Manufacturing Company's engineers have designed a series of high and low temperature fans specifically designed for the recirculation of heated gases.

All Mahr high temperature fans (800° F to 1500° F) are equipped with the very latest self-aligning, ring oiled, water cooled, precision type sleeve bearings. In addition, the shaft is equipped with an auxiliary cooling device to further dissipate heat and thereby relieve the heat load on the bearings. This assures highest recommended temperature conditions. These fans are standard equipment on Mahr Furnaces and Ovens and are also offered for replacements or initial fans are engineered to require relatively slow installations on other furnaces or ovens.

Low temperature fans are provided with bearings of proper type and, in addition, have the auxiliary cooling device.

Mahr temperature fans are engineered to require relatively slow speeds to obtain a given output of air, thus is the bearing wear, stresses and strains kept to a minimum and longer life to the unit is assured.

Bulletin 1070 containing full information is available from Mahr Manufacturing Co., 1715 N. Second St., Minneapolis, Minn. 379-D

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● If you need special design, special quality or special delivery, the chances are we can help you. Redesign may modify costs, too. This specialized organization, recognized headquarters for all that is latest and best in spring making, is at your service.
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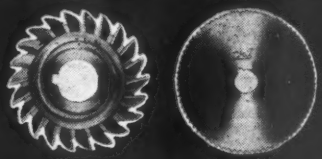
1800 Clybourn Ave.
Chicago, Illinois
(Div. Assoc. Spring Corp.)
65 Years of Knowing How RESULTS IN BETTER SPRINGS
GIBSON-SPRINGS
INQUIRIES INVITED... LARGE ORDERS... SMALL

QUICK DELIVERY

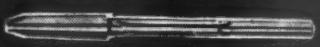
Veit CUTTING TOOLS

AIRCRAFT COUNTERSINKS

ROUTER CUTTERS



SAWS & MILLS



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Special Drills & End mills
COUNTERBORES

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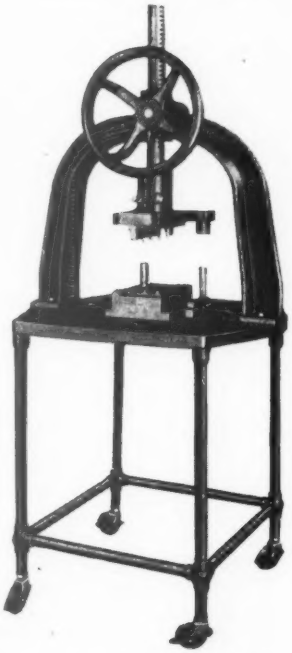
Veit Manufacturing Co.
1949 E. Kirby Detroit

Faster **PUNCH-TO-DIE ALIGNMENT**



LACEY DIE-SET MACHINE

You'll never need a pry-bar or hammer to separate punches from dies if you use this unique die-set machine. Positive, sensitive alignment is assured the die-maker, who can now complete the die-set right at his bench. Result: saving in toolroom time and improvement in the finished die.

Of sturdy, open construction, it can be operated with one hand under full manual and visual control. With the die-shoe clamped to the table and the punch-holder fixed in position in the ram, the punch can be removed as often as needed without disturbing alignment. Rugged for fitting up heavy die-sets, it is also useful for shearing in certain types of punches.

Ask today for full details.

Sole Distributors

MOORE SPECIAL TOOL CO., INC.
740 Union Ave., Bridgeport 7, Conn.

Safe, Adjustable PARALLELS

That Speed Precision Operations . . !

IMMEDIATE DELIVERY!

★ Get rid of the obsolete, dangerous method of slowly building a foundation for drilling, tapping, boring, milling, grinding and other precision operations.

Do it the war-time way . . . the safe and speedy way . . . with Acro *adjustable* PARALLELS. They are made in three sizes and handle a wide range of work.

Used in America's Big War Plants

These modern PARALLELS have become standard equipment in many of America's leading war plants . . . your assurance that PARALLELS by Acro will do much toward speeding precision operations in your plant. Act now!

See Your Jobber or Write Direct for Same Day Shipment!

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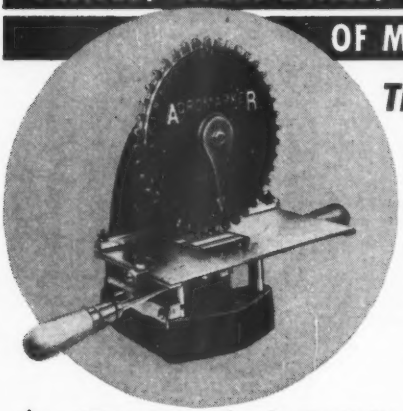
Precision Machinists ● Tools ● Dies ● Metal Specialties

FASTER, MORE ACCURATE MARKING OF NAME-PLATES, TAGS, DIALS, GAUGES, TOOLS OF METAL, FIBRE, PLASTICS



THE ACROMARKER

The No. 1 Model is especially suited for fast marking, numbering and lettering serial numbers, voltage indications, code letters, identification marks, manufacturers' key, etc. Easy to operate, the No. 1 Acromarker requires merely a swing of the handle to exert powerful screw pressure of the dies on the parts to be marked. Deep, accurate marking on stainless steel, cold rolled steel, brass, bronze, zinc, tin, plastics, fibre or other materials. Dies are automatically advanced for character spacing, and are replaceable. The Acromarker represents one of the most widely used marking machines on the market today

ACROMARK

Write for descriptive literature.

THE ACROMARK COMPANY

515 MORRELL STREET, ELIZABETH, NEW JERSEY

Empire LIVE CENTER
WITH REPLACEABLE POINT

GREATER ACCURACY • LONGER LIFE • HEAVIER LOADS • FASTER PRODUCTION

Pat. Pend.

No. 2 MT $25.00
No. 3 MT 27.50
No. 4 MT 38.50
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MOST ADVANCED LIVE CENTER MADE!

Replaceable point affords indefinite life—Tapered seat maintains perfect alignment—Very short overhang eliminates chatter—Special preloaded heavy duty bearings for heavier loads—Point is hardened and ground tool steel—Case is hardened and ground—Seat of case ground on bearings—Special points available on request.

FISHER TOOL COMPANY
226 Lafayette St., N. Y. 12, N. Y.

Only 1 Part Instead Of 15

Typical Vargo-built base for Vertical Milling Machine

That's one way Vargo reduces costs — by reducing the number of separate parts on a job, and otherwise simplifying construction. Vargo, you see, doesn't just follow a blueprint blindly, but sometimes saves money by the hatful. Such service is worth something, isn't it? Yet Vargo's quotations are not excessive. Try Vargo on your next job and see.

Vargo offers you ample facilities, thorough experience, and a pride in craftsmanship. Your inquiries are invited on flame-cut shapes, welded jigs, fixtures and machine bases, and general steel construction.

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General Steel Plate Work
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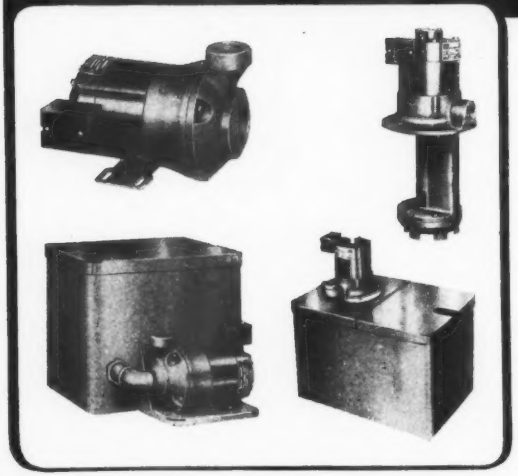
Penrod Centrifugal Coolant Pumps



Penrod Pumps Easily Applied; Give Better Service

Penrod Pumps are conventional in style but incorporate many new features such as replaceable seal assemblies, totaly enclosed motors, grease sealed ball bearings and streamlined design.

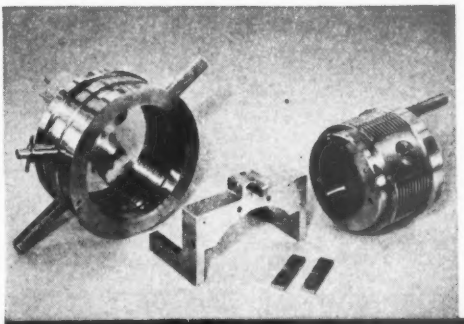
Model P-10h pump (left) uses the motor for mounting and can be located in any position as long as the liquid will flow into the pump by gravity. This pump is easily installed on old or new machines. Model P-30 V Pump (right) is for submerging into the coolant reservoir, and is especially suitable for use with coolants containing abrasives or small chips.

Tanks built especially for Model P-10-⅛ and Model P-30 V-⅛ Pumps can be supplied promptly.

Model P-10H and Model P-30 V pumps are ready for immediate delivery. Phone or wire us for details.

FLOYD PENROD & SONS
TOOL & ENGINEERING COMPANY
P. O. BOX 909 **Muncie, Indiana**

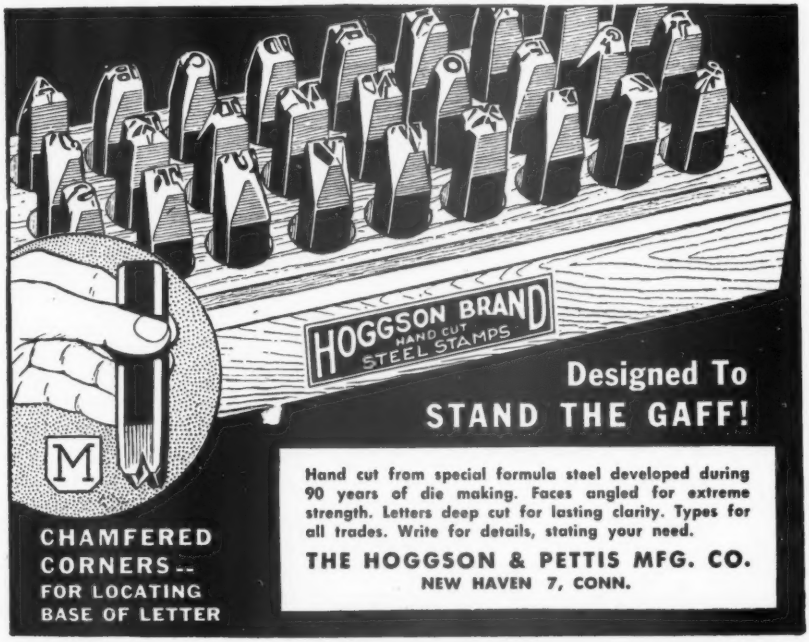
Cut Production Costs with MERZ



SPECIAL GAGES AND FIXTURES

★★★ With facilities unexcelled in the Central States, we are prepared to undertake a complete production tooling job or to design and manufacture any special gage or fixture required. Standard plain and threaded, plug and ring gages shipped promptly from stock. Write for new literature, just off the press.

MERZ *Engineering Company*
INDIANAPOLIS 7, INDIANA



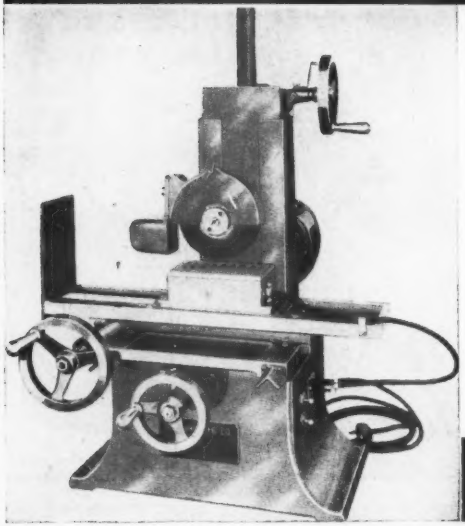
Designed To STAND THE GAFF!

Hand cut from special formula steel developed during 90 years of die making. Faces angled for extreme strength. Letters deep cut for lasting clarity. Types for all trades. Write for details, stating your need.

THE HOGGSON & PETTIS MFG. CO.
NEW HAVEN 7, CONN.

CHAMFERED CORNERS -- FOR LOCATING BASE OF LETTER

Sanford precision bench surface grinder



A
HIGH SPEED GRINDER
FOR ALL
SMALL PRECISION WORK

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BUILDERS 'T' SURFACE GRINDER

Table, guided longitudinally by patented "T-square" action, is reciprocated by a convenient lever, assuring efficient, tireless operation. Accurate, simple and versatile . . . an ideal machine for women operators.

PROMPT DELIVERY

Send for Bulletin 644

BUILDERS IRON FOUNDRY
23 Codding Street
PROVIDENCE, R. I.

BOYAR-SCHULTZ

COPPER HEAD LAPS

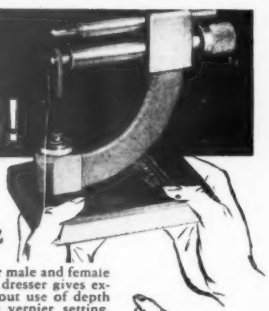
Consider the time saved in your tool room when you use Copper Head Laps instead of making laps in your own shop. But that is not the only saving. Boyar-Schultz Copper Head Laps do not wear out. The only wearing part is the inexpensive copper sleeve. Adjustment feature permits maintaining the correct lapping size till sleeve is worn out and is replaced with a new sleeve. Available from stock in standard sizes, 1/8" to 2 1/2".

SAVE TOOL ROOM TIME

BOYAR-SCHULTZ CORPORATION

2112-L Walnut Street **CHICAGO 12, ILLINOIS**

STOP *Risking* SKILLED HANDS!



MAKE-ALL RADIUS DRESSER

Safe in Operation

The hands of your skilled workmen are not exposed to unnecessary accident risks when they use the Make-All Radius Dresser . . . its simple construction and easy operation are designed to keep operator's hands away from the revolving grinding wheel. A time-saver for male and female radius dressing . . . this dresser gives exceptional accuracy without use of depth gauges, micrometer or vernier setting. Priority rating with your order will assure prompt delivery.

ATTACHMENT FOR FULL SEMI-CIRCULAR RADII

Only tool of its kind! Use with Golconda Rattail Diamond Tools to make full semi-circular radii as small as 0.035". Available at small extra cost.

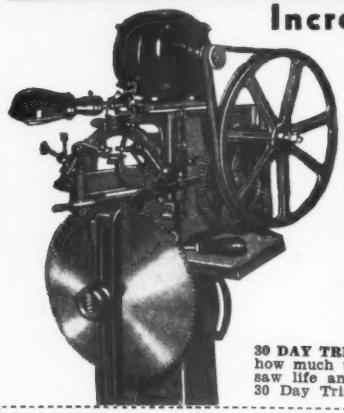
$61.00 RADIUS DRESSER with one 90° GOLCONE Diamond Tool.

$97.50 *Complete* MAKE-ALL with 2 Golcones (60° and 90°), one crystal point, one roughing tool, one Semi-Circular Radii Attachment, and 3 Rattail Diamond tools (1/8", 3/32", 1/16").

GOLCONDA **Diamond Products Corp.**

3854-58 No. Ashland Ave., Dept. TD-3
Chicago, 13, Illinois

FOLEY FILED SAWS



Increase Sawing PRODUCTION

25% TO 40%

Your saws will cut faster and truer and stay sharp longer when filed on a Foley Saw Filer, which automatically joints the saw as it is filed. The exclusive patented Foley jointing principle straightens up uneven teeth and makes them perfect in size, shape, spacing. Foley automatic filing not only increases sawing production 25% to 40%, but greatly reduces saw breakage and doubles the cutting life of your saws. Any man or boy can operate the Foley Automatic Saw Filer, the only machine that sharpens cross-cut circular saws 3" to 24" in diameter, band saws ⅛" to 4½" wide—all hand saws. It cuts down filing time and saves on files.

30 DAY TRIAL IN YOUR OWN PLANT. Find out on your own work how much the Foley Filer can save you in increased output, longer saw life and reduced filing costs. Send coupon for details of our 30 Day Trial Offer.

FOLEY MFG. CO., 4 Second St. N. E., Minneapolis 13, Minn.

Send literature and details of your 30-Day Trial Offer.

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ADDRESS.....

BARTELT

NEW MODEL "C" PEDESTAL INDICATOR

Specially designed for accurately resetting precision boring bar tools, and for similar work. The upright has a vee base, with flats for working off a plane surface. The indicator, reading to ten-thousandths of an inch, has an adjustment of 1" along the slot in which it is clamped. This gage is intended for fixed setting to check precision tools on production jobs, and thus speed up resetting of tools after replacement or resharpening.

Write for new Circular

Showing all models, "A", "B", and "C", of Bartelt Pedestal Micrometers and Pedestal Indicators together with specifications and list prices.

BARTELT
ENGINEERING COMPANY
1212 PARTRIDGE AVE.
BELOIT • WIS.

PRODUCTO CAM LOCK VISES

Producto Cam Lock Vises, 4", 5" and 7", are used every day in plants producing machine guns, rifle, pistols and carbines. The best production vise for milling and drilling operations, positive clamping and quick-acting.

Ask for complete information on all Producto Vises.

THE PRODUCTO MACHINE COMPANY

3017 MEDBURY, DETROIT, MICHIGAN

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PRODUCING
DRILL JIG BUSHINGS
and
OTHER PRECISION ITEMS
for
VICTORY!

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ACME INDUSTRIAL COMPANY

Makers of Standardized Jig and Fixture Bushings

206 N. Laflin St. Chicago, Ill. MONroe 4122

NEW! Hammond

10" and 14" WET TOOL GRINDERS

FOR

CARBIDE TOOLS and HI SPEED, Too!

Grinding wet, helps prevent tool tip crazing and flaking, and eliminates heat cracks.

New features of the Hammond 10 and 14: No Spray-No Splash concealed wheel guards provide greater operator freedom and complete visibility of work; Adjustable Coolant spouts swivel in and out with flooding action of the coolant; Safety Cup disc prevents operator from accidental dropping of tool into cup of cup wheel.

SEND FOR BULLETIN NO. 206

Hammond Machinery Builders INC.
KALAMAZOO 54, MICHIGAN
1631 DOUGLAS AVENUE
Eastern Branch—71 W. 23rd St., New York 10, N. Y.

TWO MACHINES IN ONE!

For Die-Filing Use Top Table in Position Shown.

For Punch or Blind-Hole Filing Tilt Top Table Back, Use Lower Table.

Adjustable Stroke 0" to 1½"

DIE TABLE Filing From Below

Adjustable Friction Drive

PUNCH TABLE Filing From Above

No more hand filing of intricate jobs or inaccessible parts! With this Duplex Die and Punch Filing machine you can take care of all filing and lapping jobs as they come along. Stroke fully adjustable from 0 to 1½". Two Speeds. Fully enclosed motor. Ball Bearings throughout. No dripping of oil. No waste of unused file sections.

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IDEAL TOOL and DIE CO., INC. - 735 CONGRESS STREET SCHENECTADY, N. Y.

Style 200 Straight Side Shop Box

A straight side shop box with drop handles each end. Excellent for shop use where stacking feature is not required.

Style 300 Stacking Box

Just right for your small parts. Light in weight, easy to handle. Equipped with drop handle each end. Runners save wear on bottom of box and act as positive stacking lock.

IMMEDIATE SHIPMENT

STEEL BOXES

FOR YOUR PRODUCTION NEEDS

No. 201	6″	x 9″	x	3½″	— 20 ga.	$ .40 Ea.
No. 202	8″	x 12″	x	4″	— 20 ga.	$ .45 Ea.
No. 203	9″	x 13½″	x	4½″	— 19 ga.	$ .60 Ea.
No. 301	6″	x 9″	x	3½″	— 20 ga.	$ .55 Ea.
No. 302	8″	x 12″	x	4″	— 20 ga.	$ .60 Ea.
No. 303	9″	x 12½″	x	4½″	— 19 ga.	$ .75 Ea.

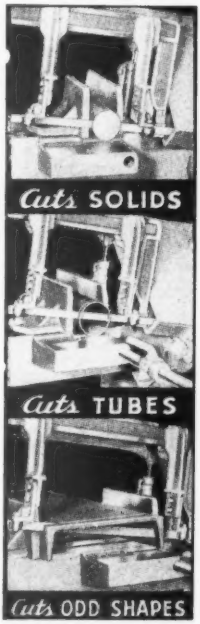
Prices F.O.B. Factory, Phila.—Any Quantity!
Order Today—Write, Wire or Phone

AMERICAN METAL WORKS, INC.

1531 Germantown Avenue Phila. 22, Pa.

NO Lost Motion On Cut-Off Work

Faster, as the Cutting Action Is Continuous



KALAMAZOO

Metal Cutting Band Saw

The modern method for handling 95 per cent of all cut-off work. FASTER, as cutting action is continuous. MORE ACCURATE, as it makes a wafer-thin cut to close tolerances.

Small investment—low upkeep and depreciation—and easy setup.

COOLANT ATTACHMENT for production cutting or for hard metals. Saves Saws and triples speed.

Two sizes—Four speeds. Portable—plugs in anywhere

Ask for Saw Bulletin

MACHINE TOOL DIVISION Kalamazoo Tank & Silo Co., Kalamazoo, Michigan

Rivet Salvage Problem Solved

LOOKING for an answer to one of their customer's war-time problems, The Cleveland Pneumatic Tool Co. has announced its latest device, the Cleco Riv-N-Jector. Airplane manufacturers have discovered that their smallest, yet most numerous unit of construction—the rivet—was creating an expensive bottle-neck in their all-out production schedules. Because of its small size, the rivet is difficult to handle and workers become careless and wasteful in their efforts to insert them into the small holes of the metal sheets. Salvaging of dropped rivets is a costly procedure. It requires sorting for size, cleaning, checking for damage, and with the "cold" rivet, rechilling.

Designed to be easily handled by women operators, the unit is as light as a feather, and has a magazine holding up to 50 rivets. A special nose jaw holds a single rivet ready at all times for inserting into the hole of the metal as easily as pointing a pencil at the same hole. Easy to operate, practical to use, it eliminates one of the irksome features of the riveting job—tediously juggling a handful of rivets.

In announcing the Riv-N-Jector, Cleco's foresight includes suggested plans for laying out a complete riveting department. These plans comprise arrangement of hoppers for the rivets and storage boxes for hot and cold operations. The layout with its rivet stations and rivet center is based on actual recommended practice as installed in several large airplane fabricating plants.

Complete information can be obtained by asking for Bulletin 89. Available from Cleveland Pneumatic Tool Co., 3781 E. 77th St., Cleveland, O. 239-D

The critical wartime need for conservation of both steel and manpower plus conversion from manpower to womanpower stimulated the development of all-plastic dies as described in this issue by David Cook of Los Angeles.

Castolin Eutectic

EUTECTIC

(Means Lowest Binding Alloy)

LOW TEMPERATURE WELDING

SALVAGING DEFECTIVE MACHINED CASTINGS — WITH MACHINABLE EUTECTIC "COLDARC" ALLOY NO. 24

Problem

Salvaging already-machined cast-iron, malleable iron or chrome-nickel alloy steel castings having porous spots or machining errors. . . . When ordinary electrodes were used a hardened fusion line generally resulted. Naturally, this caused great difficulty and time-waste in machining the welded sections.

Solution

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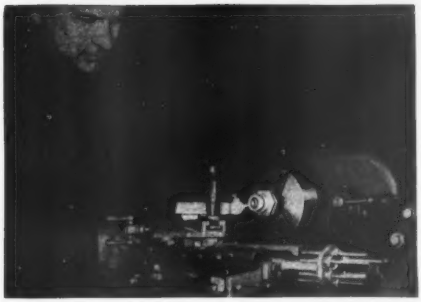

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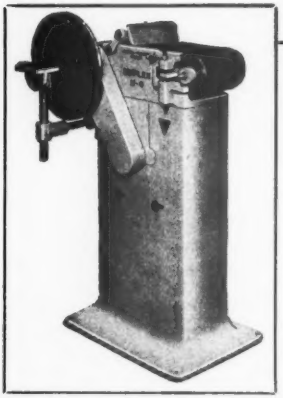

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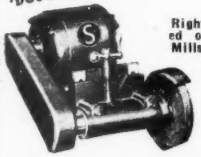

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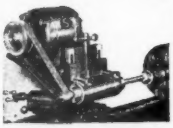

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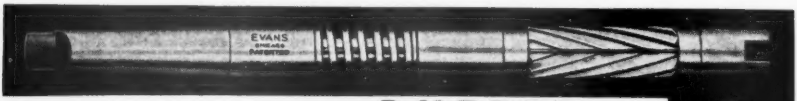

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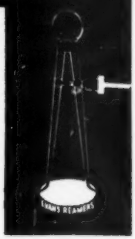

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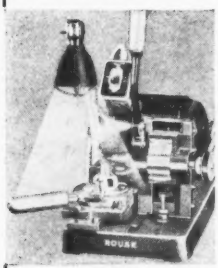

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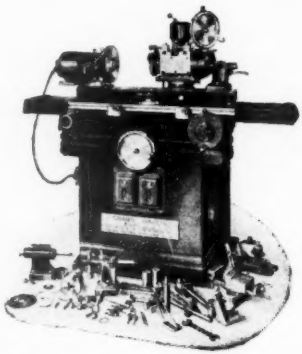

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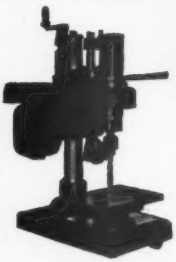

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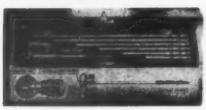

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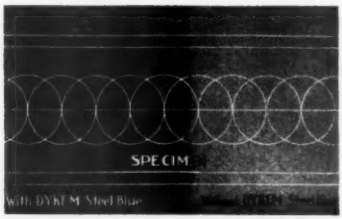

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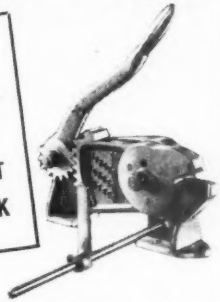

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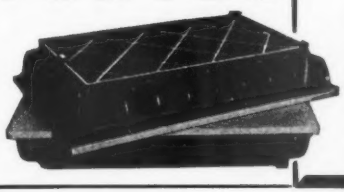

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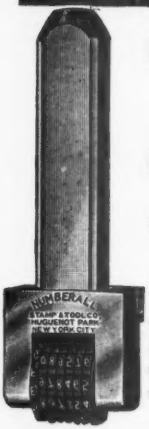

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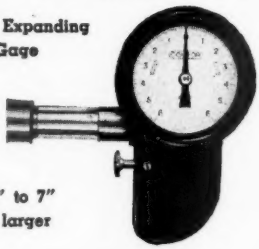

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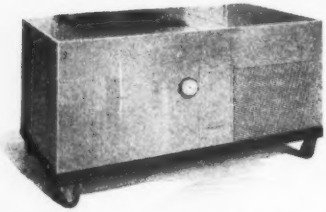

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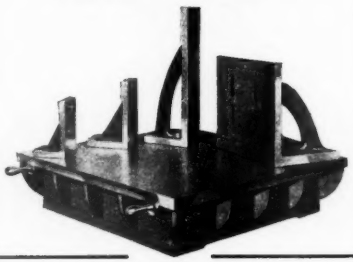

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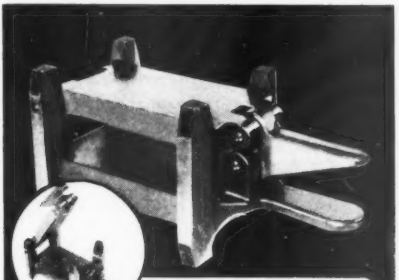

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Made of Nickle Iron normalized with Jig frame and cover finished top, bottom and both sides. Base is not finished. 5 Standard Sizes! Special Sizes and Heights on Request.

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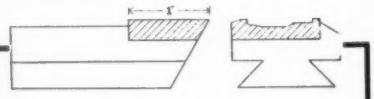

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We use a CARBIDE TIP 1″ LONG which will give you almost 1″ of tool grind.

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Be 100% with your **10%** *Buy* **WAR BONDS**

INDENT or ETCH
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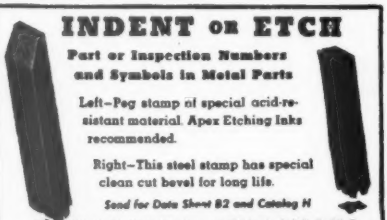

Left—Peg stamp of special acid-resistant material. Apex Etching Inks recommended.

Right—This steel stamp has special clean cut bevel for long life.

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16 ga., drag holes and handles both ends.
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(Continued from Page 233)

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15 STANDARD SIZES
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Here is a simple 3-STAGE explanation:

"DIE-LESS DUPLICATING" might be described as a new industrial technique made possible by the accuracy, extreme adaptability and ease of operation of DI-ACRO Precision Machines—Shears, Brakes, Benders —especially when used as a continuous, integrated production process.

←1ST STAGE . . .

Cutting flat material to size and shape for part to be duplicated. The DI-ACRO shear rapidly resizes and squares material, also makes slits, strips, notches, angle cuts, etc. Guides, stops and blade pitch are all quickly adjustable. 3 sizes—shearing widths 6", 9", 12".

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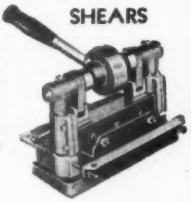
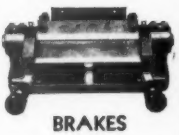
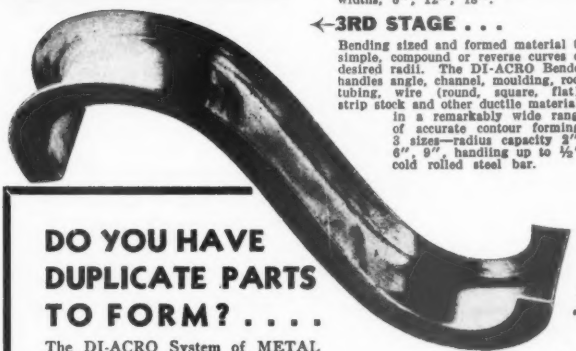


←2ND STAGE . . .

Forming angles, channels or "Vees" from sheared flat material. The DI-ACRO Brake forms any angle from 0° to a maximum of 110°. Contact surfaces are adjustable and may be slotted, recessed or altered as needed for the parts required. 3 sizes—folding widths, 6", 12", 18".



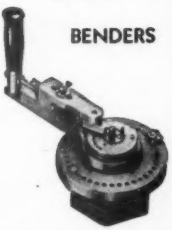
BRAKES



←3RD STAGE . . .

Bending sized and formed material to simple, compound or reverse curves of desired radii. The DI-ACRO Bender handles angle, channel, moulding, rod, tubing, wire (round, square, flat), strip stock and other ductile materials in a remarkably wide range of accurate contour forming. 3 sizes—radius capacity 3", 6", 9", handling up to ½" cold rolled steel bar.

BENDERS



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The DI-ACRO System of METAL DUPLICATING WITHOUT DIES has proven its adaptability in making parts just as accurately as can be done with dies, to a tolerance of .001" in all duplicated work. The delay of waiting for dies is avoided—deliveries speeded up. Changes needed in production can be made simply by adjustment of DI-ACRO Precision Machines, which are also widely used for laboratory and research work, making models, etc. Production work is often done in excess of 1,000 operations per hour, by girls or inexperienced workers.

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"METAL DUPLICATING WITHOUT DIES"

It gives full details on all models of DI-ACRO Shears, Brakes, Benders, and many examples of parts made with "DIE-LESS DUPLICATING".

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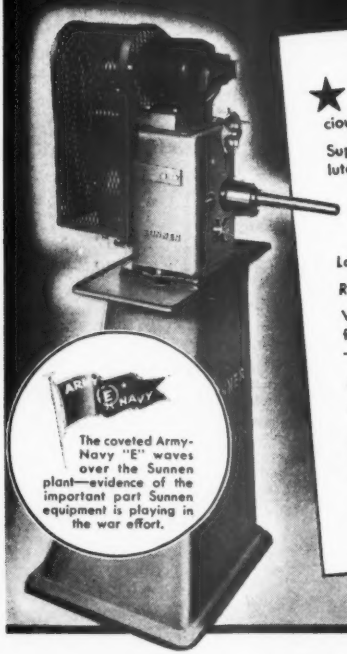

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★ Its greater accuracy assures fewer rejects—conserving not only vital war materials but precious manhours of labor as well.

Super-smooth finish and accuracy make possible absolute interchangeability of parts — another time and money saving feature.

Skilled labor is not necessary! Operators, even girls in 'teens, can be trained in a few hours.

Low in cost — economical to operate.

Relieves big internal grinders for other important jobs.

Wide range — handles internal cylindrical surfaces from .185" to 2.625" in diameter. No jigs or fixtures — work held in hands.

Accuracy within .0001" guaranteed.

Put Sunnen Honing to work in your plant!

Write for complete information—or we'll gladly have a Sunnen engineer call and show you what the Sunnen Precision Honing Machine can do on your job in your plant.

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Canadian Factory: Chatham, Ontario

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Aircraft Valve Tappet Roller. 4-Micro finish.

Drill Jig Bushing "Increases sales appeal of product."

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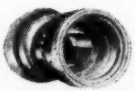

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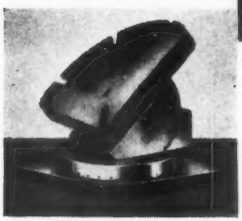

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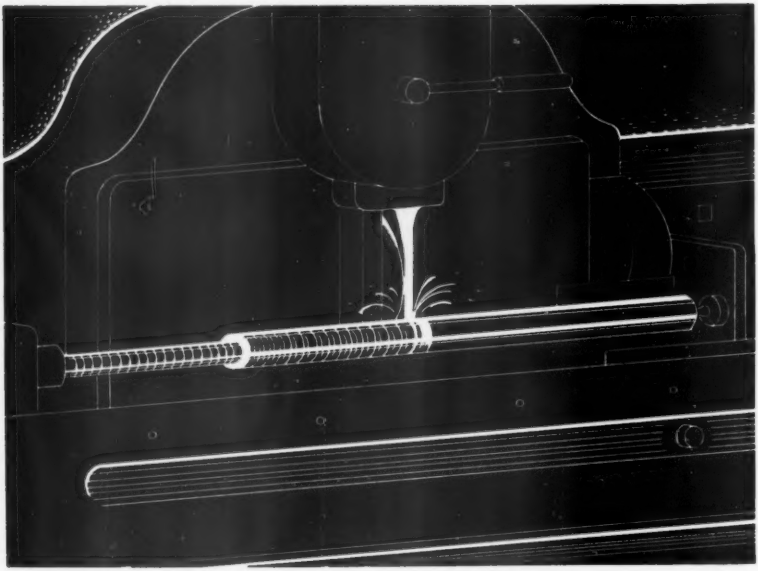

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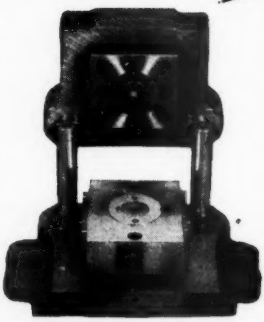

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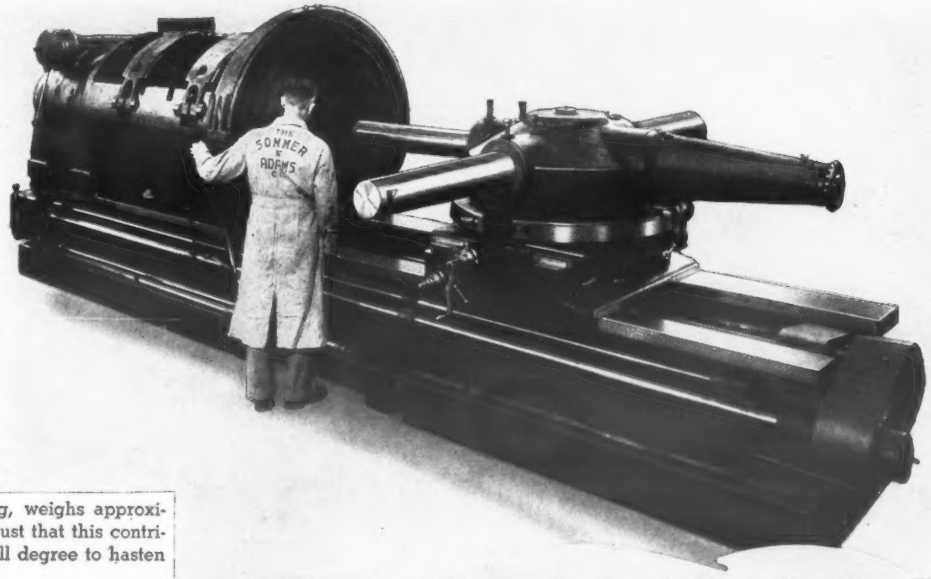

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